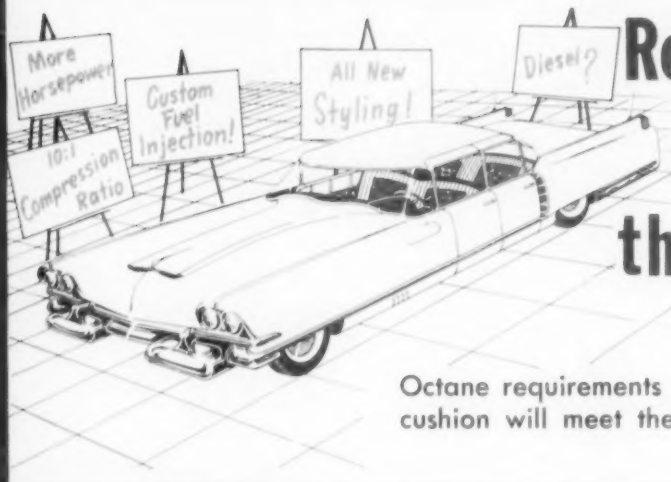
the OIL AND GAS JOURNAL

SEPTEMBER 10, 1956



Refiners are ready for the 57 cars!

Octane requirements will be up, but present cushion will meet them with room to spare

p. 78

Rubber Balls—New Fracturing Tool

p. 86

Central America Gets First Producer

p. 96

Drilling Fluid for Hot Holes

p. 104

Complete table of contents and article digests on pages 2 - 3

one point and purpose

Doing one thing best was once enough to maintain service leadership. But we soon found that completion service was much improved by adding other closely integrated services . . . each one helped the others put more oil in the tanks.

1 ELECTRICAL WELL SERVICES

2 FORMATION FRACTURING

3 CEMENTING SERVICES

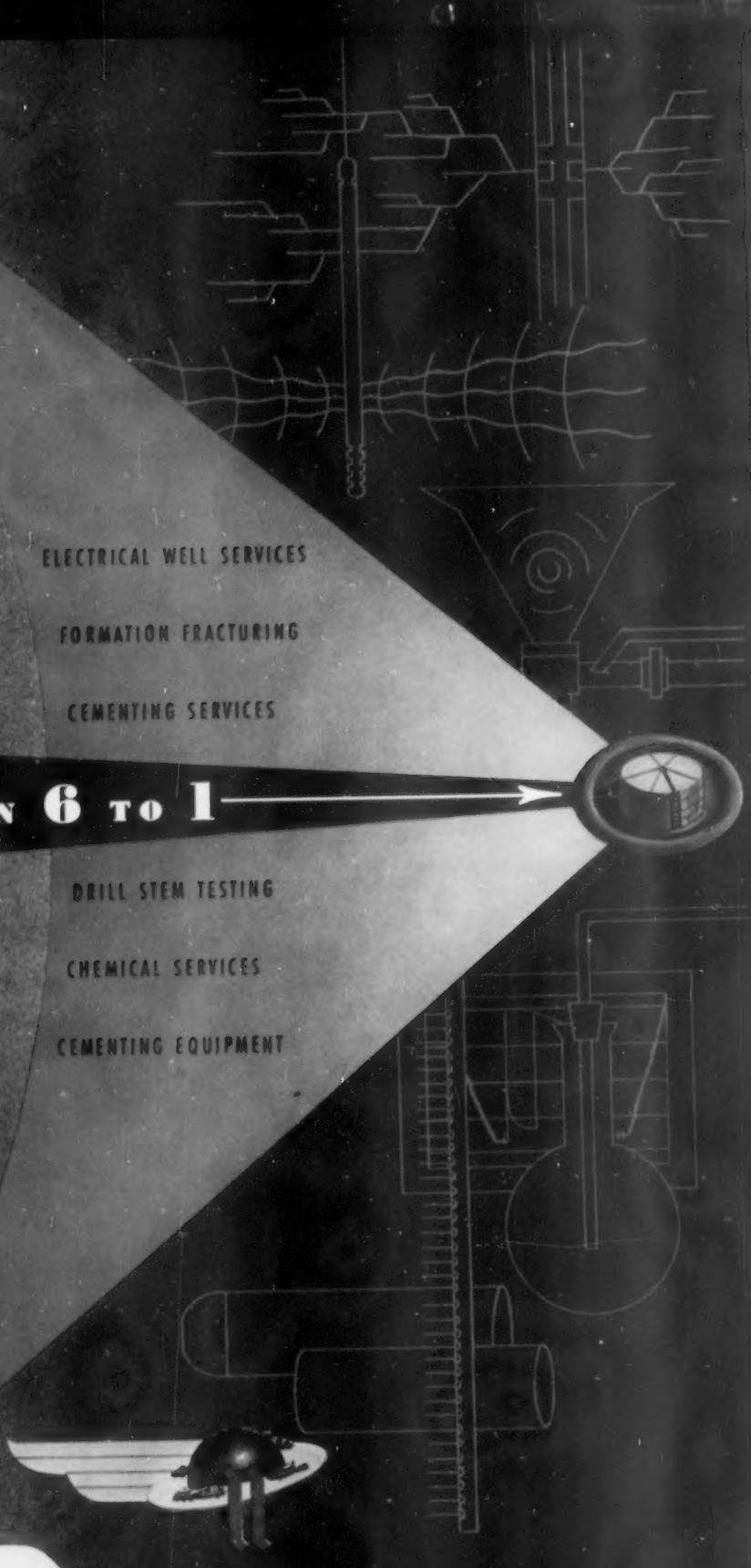
IT'S HALLIBURTON 6 TO 1

4 DRILL STEM TESTING

5 CHEMICAL SERVICES

6 CEMENTING EQUIPMENT

Improving your production is the one point and purpose for Halliburton's six well-completion services. You gain more, too, by working with this one good source for all six . . . one source that emphasizes service beyond the fee, service above all . . . one source that believes research is its most important service.



HALLIBURTON

OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

"PROGRESS IN SERVICE THROUGH RESEARCH"

A Glance Ahead . . . . at press time

These trends will make TOMORROW'S NEWS

An upsurge in Rocky Mountain drilling by the independent is in prospect. The reason: A government clampdown on rules which limit the acreage any one company can hold.

In the past many majors have paid little attention to the acreage restrictions. But as the Government gets stricter, more farmout deals likely will be made. Under these, the independent will benefit from the exploration thinking of the major company. And in many cases he may wind up with a deal giving him dry-hole money as well as acreage.

The new policy will open a wide new area to many independents, who, because of generally high costs elsewhere, have been limited largely to the Denver-Julesburg basin.

Congress next year will be faced with the need either to enact Harris-bill type legislation or give the Federal Power Commission standards and basic rules for the regulation of independent gas producers.

Many industry men are confident that a bill exempting independent producers from federal regulation will be passed and accepted by the White House, no matter which party is in power. But if this doesn't happen, the FPC will have to be given some definite guidance if it is to do the job forced on it by the Supreme Court.

Gulf-type drilling platforms are being studied by several major companies for possible use off California.

Monterey Oil Co. was the first to obtain such a unit. Current reports are that several more platforms will be ordered soon. At present offshore operators are using seven converted landing craft as floating drilling barges. So far, drilling from these floating platforms has been confined to coring operations.

Insurance requirements are limiting the spread of air drilling. Rates are prohibitive unless elaborate blowout-prevention or packoff equipment is used —and the small contractor often can't see footing the bill for the extra devices, in spite of the increased drilling speeds and other advantages of air drilling. More progress will come if and when contracts include enough wells to justify the little contractor's investment in safety equipment.

Liquid cyclones for separating either sand or barite from drilling mud are gaining favor.

Field tests show a single cyclone can separate up to 50 tons of solids a day, with water savings of over 80 per cent for unweighted muds and barite savings of over 60 per cent for weighted muds. Maintenance is low, since the only moving parts are in pumps which force the mud through the cyclone.

Not in this decade, but not too long thereafter, the U. S. Navy will be freed from the limitations on movement imposed by fuel needs. An experimental atomic power plant which ran uninterruptedly for 66 days shows the way, according to naval experts.

Atomic energy, already in use in the submarine Nautilus, will free combat vessels from the need for oilers and fueling stations. But oil probably will continue to fuel fleet-supporting vessels for years to come.

The OIL AND GAS JOURNAL

SEPTEMBER 10, 1956 • VOLUME 54 • NUMBER 71

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IN THE NEWS

Processing:

Refiners Ready for Souped-Up 1957 Autos 78
Processing Briefs 81
Octane Ratings Holding Steady 82
Refinery Building Mushrooms in Pacific Northwest 90
Plant Operators in Texas Now Police Flaring 90
Two More Majors Take Stands on Third Grade 91

Drilling-Production:

Alabama Geologist Paints Bright Future for Citronelle 85
Little Rubber Balls New Aid in Big Frac Jobs 86
Dresser Makes New Deal for Russian Turbodrill 87
Industry's First Diesel-Electric Rig Due for Test 92
Production Being Stepped Up in Neutral Zone 99

Exploration:

Argentina, Brazil Develop Energetic Oil Plans 94
Costa Rica Find Gives Central America First Commercial Oil 96
Wild Iranian Gusher Forms Lake of Oil 98
Venezuelan Tracts Bring Big Bonuses, Fringe Benefits 99
Italy Confusing: Cities Service May Enter, Gulf Go 101
West Africa Gets First Commercial Gas Discovery 101
Jersey Standard Affiliate Hits Gas in Sicily 101

Pipelines:

Magnolia's Crude-to-Products Conversion Paying Off 82
Crude Line From Four Corners to California Proposed 83
El Paso Natural Rejuvenates 27-Year-Old-Line 84
Shell Boosts Capacities of Rancho, Butte Lines 90
Showdown Nears Over T.G.T., Trans-Canada Pact 91
Weather Delays Products Line to Air Bases in Spain 99

General Interest:

FPC Refuses Rehearing on Controversial "Black Dog" Case 85
Oil Industry Is Paying A High Tax Bill 86
Attorney General Sidesteps Interstate Oil Compact Issue 88
Panhandle Stockholders to Vote on Merger with Petrofina 88
House Commerce Committee Plans Extensive Oil Studies 91
Another Trinidad Sale Nears Completion 94

OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
EXPLORATION • DRILLING • PRODUCTION • FIELD PROCESSING

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TECHNOLOGY–OPERATION

Drilling-Production

A New Fluid for Deep Drilling **104**

By R. F. Burdyn and L. D. Wiener

A new flocculated, neutral-pH drilling mud promises to eliminate most of the mud problems found in deep drilling. It has allowed drilling of thousands of feet of previously undrillable shale, at temperatures of up to 400° F.

Automatic Tank Switching at West Jennings **114**

By Ed McGhee

Two 5,000-bbl. tanks in The Texas Co.'s West Jennings field, Zapata County, Texas, are 25 miles by road from the rest of the operations. Automatic switching and remote-gaging facilities, powered by a 9-mile radio link, have reduced costs and increased efficiency.

Shell's Big Diesel-Electric Rig Drills First Hole **116**

By Ed McGhee

Shell's Rig 11 is equipped to drill through 14,000 ft. of salt and set a 9⅝-in. protective string. The rig is equipped with nine 625-hp. d.c. motors and three 875-hp. diesel-engine-generator sets.

Modern Drilling **142**

Pipelining

New Pulsation Dampener for Piston Pumps **120**

By M. Ludwig

If you are having pulsation troubles with positive-displacement pumps, check these design formulas. They result from a rigorous mathematical analysis based on electrical analogy and offer a method of designing a new type of dampener.

Pipeline Patrol: New Chart for Gas Flow **157**

By M. Navidi

A new graph for solving problems in gas-flow measurements and pressure-drop calculations. All variable factors are included in the graphical solution.

Refining-Processing

Maintaining the Cat Cracker—4: Flexible Pipe Joints **108**

By J. S. Clarke

Flexible pipe joints absorb compression, tension, angular movement, and lateral movement due to thermal expansion in the catalytic cracker piping system. Here's how to design and maintain them.

Petrochemicals Rise 40 Per Cent in U. K. **111**

Output of the U. K. petrochemical industry has risen 40 per cent since 1953, and is due for another 67 per cent rise by 1958. Biggest developments are in the fields of ethanol, raw materials for plastics, synthetic rubber, and detergents.

Making Ethylene—6: More Methods of Recovering Ethylene **113**

By H. C. Schutt and S. B. Zdonik

Discussions of these topics having to do with the separation: (1) low-temperature absorption and fractionation; (2) adsorption, and (3) refrigeration systems.

Foreman's Page **141**

Field Processing **145**

Refiner's Notebook **147**

Cost-imating **149**

DEPARTMENTS

A Glance Ahead	**1**	Foreman's Page	**141**	Personals	**217**
They Say	**63**	Modern Drilling	**142**	Deaths in the Industry	**219**
Calendar of Events	**67**	Field Processing	**145**	Statistical Summary	**220**
Journally Speaking	**73**	Refiner's Notebook	**147**	Drilling Statistics	**221**
Editorial	**75**	Cost-imating	**149**	Supply Statistics	**222**
This Week	**77**	Drilling Contractors	**153**	Refining Statistics	**223**
Watching Washington	**83**	Pipeline Patrol	**157**	Markets	**224**
International News	**94**	Equipment Digest	**163**	Selected Monthly Data	**225**
Books	**128**	Equipment Men in News	**175**	Classified Advertising	**226**
On the Job . . . In the Fields	**137**	Exploration Highlights	**183**	Advertisers' Index	**231**

Check the Chart!

. . . AND YOU'LL UNDERSTAND WHY MEN WHO KNOW SUCKER RODS *"SPECIFY NORRIS"*

Years of experience have proved the dependable high quality, long lasting characteristics of Norris Sucker Rods. Now Science, through comprehensive tests, shows why the name Norris is synonymous with the best.

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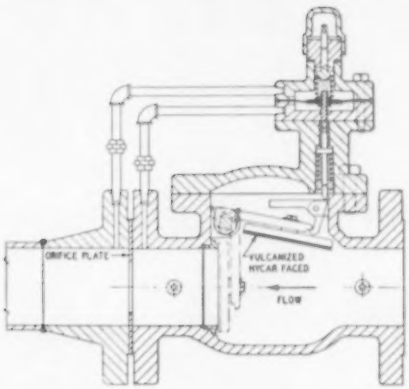
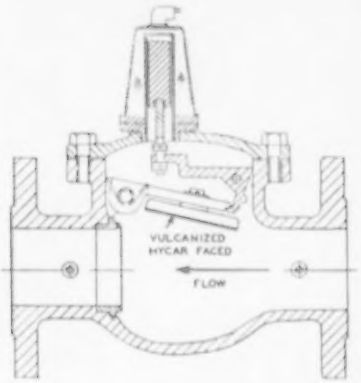
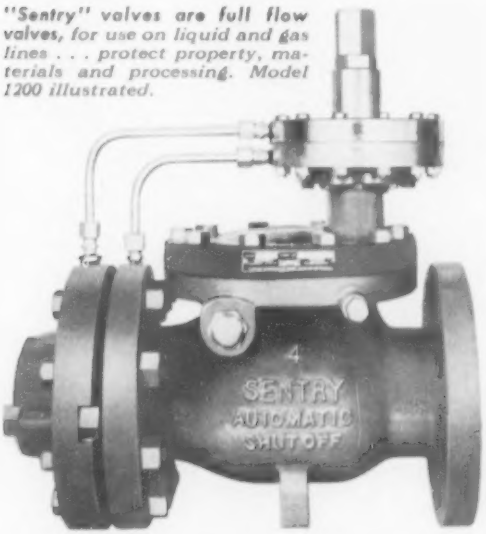


Model 1200. "Sentry" **excess flow valve** *automatically and instantaneously shuts off when the rate of flow in the line exceeds a predetermined rate.*

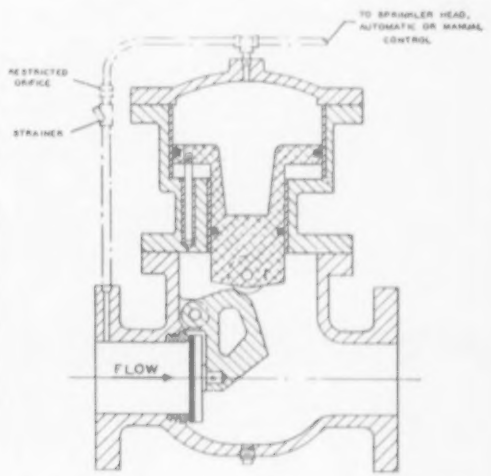


Models 1700 and 1800 "Sentry" **solenoid shut-off valves** *operate by remote electrical control automatically and instantaneously. In Model 1700, solenoid is energized, in Model 1800 solenoid is de-energized to maintain flow.*

"Sentry" valves are full flow valves, *for use on liquid and gas lines . . . protect property, materials and processing. Model 1200 illustrated.*



Other types "Sentry" Valves: high-pressure and low-pressure and over temperature shut-off valves available.



Model 3000 "Sentry" **piston operated quick-opening valve** *opens instantaneously when the pressure above piston is released. Ideal for deluge systems — and for remote opening and closing of fuel line.*

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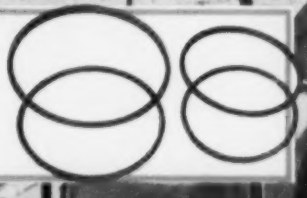
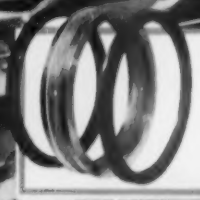


Gaskets . . . for cylinder heads and valve covers are made to rigid specifications and exact dimensions so as to provide dependable sealing with maximum service life.



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DI-HARD Liners . . . with their armoured lining of patented DI-HARD metal average up to 43% more service life than other makes. Yet their cost is competitive. Their low coefficient of friction resists wear and contributes to longer piston life.

Valves and Seats . . . are designed with above-average metal-to-metal contact, yet have more fluid flow area through the seat to improve pump operating efficiency.

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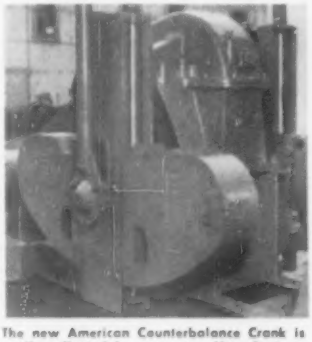

The new American Counterbalance Crank is easily adjusted by one man. New features make this adjustment completely safe. Available on all units from T9 to T27.

"Exact-Sized" American Units Save Power and Operating Cost

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MEASURING THE UNSEEN

Although attempting nothing so spectacular as measuring unseen stars through a 200-inch telescope, Tuboscope research is paying off for oil men everywhere. From Tuboscope research have come new instruments for measuring the nearly unseen effects of wear, fatigue, and corrosion in oilfield tubular goods. And from Tuboscope experience in the field comes the ability to inspect and to grade your tubular goods with the greatest possible precision and with the least chance for human error. The important factors of bottom hole pressure and temperature are measured by Tuboscope's Subsurface Engineering Division.

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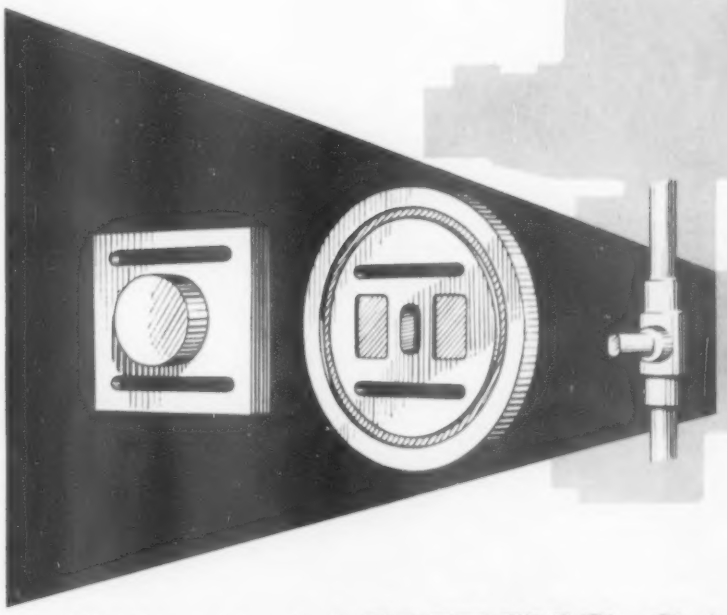

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Unusual sensitivity, dead end shut-off, close control, self-lapping action. Metallic diaphragm—no lubrication necessary.

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Most versatile OPW-JORDAN valve. Applications: remote control, back pressure control, relief service or pressure reduction. Action easily reversed in field without special tools. Excellent for control work — exceptional rangeability. Domes suitable for operation with line pressure or remote control equipment.

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Vibration is virtually non-existent in the CFA. The Clark Balanced/Opposed design eliminates unbalanced forces and vibration. It won't "travel or walk away", even if operated on a glass-smooth floor. You can set it and forget it. In the field there is no need for a dozen or more yards of concrete to hold it down . . . use just enough to level it, that's all!

Where can the CFA be used? Practically anywhere that you have a need for a 75-200 horsepower packaged compressor. Boosting into gathering lines or to larger stations, gas lifting, pipeline testing and air drilling are only a few of its uses.

There are many added features that you will probably want to know about. There is a Clark CFA specialist near you who has all the facts and would be pleased to discuss your needs. Don't delay—call today.

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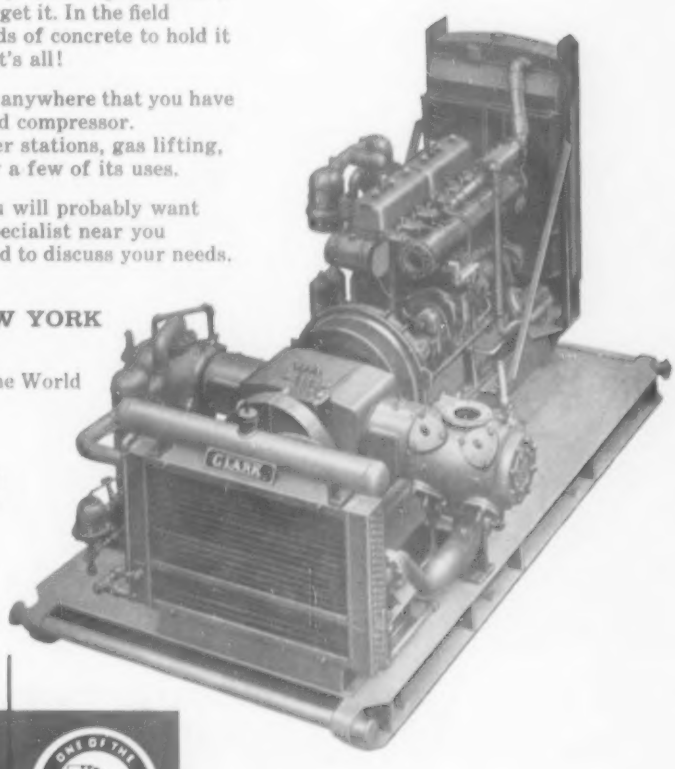
One of the Dresser Industries

Offices in Principal Cities Throughout the World



Clark 175 BHP CFA-2 Balanced/Opposed Packaged Compressor station.

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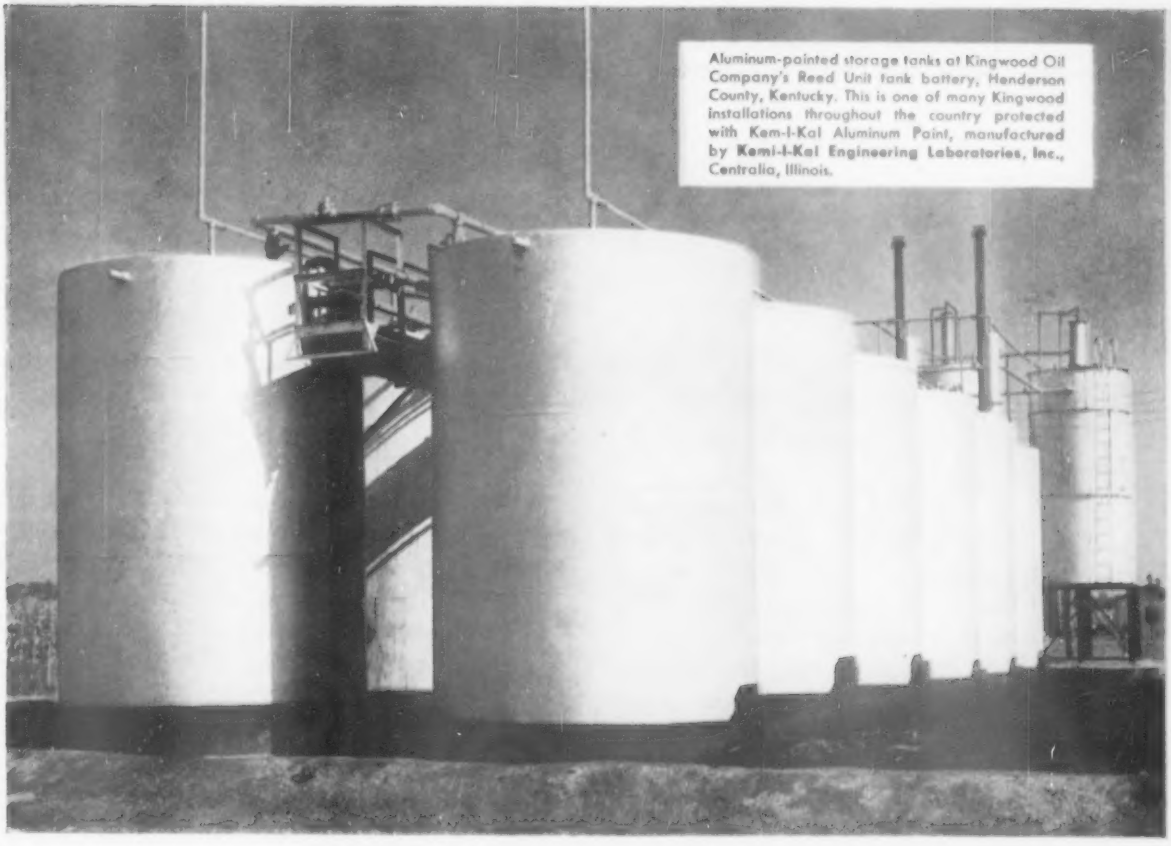
ONE OF THE DRESSER INDUSTRIES

Packaged Field Compressors

You and I both belong here! After all, there wouldn't *be* any busy highways without us! I'm a secretary to a land man. You may be anything from a driller to a board chairman. Between us we helped keep over 50 million cars on the road last year. People used them for fun, convenience, business. Remember that, the next time you hear unfair criticism of us oilmen. We've got lots of facts on our side. Let's speak up and make the facts known! **SHELL OIL COMPANY**



Aluminum-painted storage tanks at Kingwood Oil Company's Reed Unit tank battery, Henderson County, Kentucky. This is one of many Kingwood installations throughout the country protected with Kem-I-Kal Aluminum Paint, manufactured by **Kemi-I-Kal Engineering Laboratories, Inc.**, Centralia, Illinois.

KEM-I-KAL ALUMINUM PAINT OUT-PERFORMS OTHER PAINTS AT KINGWOOD OIL COMPANY

Comparison proves aluminum paint best for reflectivity, durability, appearance

For years, the Kingwood Oil Company has been a satisfied user of Kem-I-Kal Aluminum Paint, pigmented with ALCOA® Aluminum. The decision to paint equipment with aluminum has not been a "by chance" selection, either, reports the company. Other paints have been tried, but aluminum paint has always proved to be superior . . . with four big advantages:

First, aluminum paint's reflectivity greatly reduces vapor loss from crude oil stock tanks. Second, aluminum paint lasts longer, gives better protection at less cost because of greater durability. Third, aluminum paint performs better in spray equipment. Fourth, and best of all, says Kingwood, bright aluminum paint is easily cleaned, always presents the neat, attractive appearance so important to the oil and gas industry.

ALCOA does not make paint, but ALCOA Aluminum Pigments are used in more aluminum paints than any other brand. Special formulas have been developed by your paint manufacturer to solve individual problems. Paints made to these formulas actually cost less, last longer, give utmost protection against heat, cold, sun, rain, smoke and fumes.

Write today for our two FREE booklets, *Painting With Aluminum* and *Aluminum Asphalt Roof Coatings Make Time Stand Still.* They contain valuable, up-to-date information on all types of aluminum paint and aluminum asphalt coatings. Use the coupon.

Aluminum Company of America, Paint Service Bureau
1792-J Alcoa Building, Pittsburgh 19, Pennsylvania.

Please send me your FREE booklets:
- ☐ Painting With Aluminum
- ☐ Aluminum Asphalt Roof Coatings Make Time Stand Still

I am interested in protecting _____
Name _____
Company _____
Address _____
City _____ Zone _____ State _____

THE ALCOA HOUR
TELEVISION'S FINEST LIVE DRAMA
ALTERNATE SUNDAY EVENINGS

PIGMENTED WITH
ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

PERFORMANCE REPORT ON AMERICA'S BEST SELLING TRUCKS:

"CHEVROLETS COST LESS ARE ALSO MORE

. . . says Mr. J. P. Elkins, Elkins & Choate, Well Servicing, Graham, Texas—a typical user of Chevrolet heavy-duty trucks

"We recently purchased a Chevrolet Model 10703 tandem unit. This truck with equipment weighs 35,510 lbs. and the operation has been quite satisfactory. Our driver reports that with power steering (standard equipment) this unit drives like a passenger car. The Chevrolet complete unit costs less to buy and our experience in the past shows that they are also more economical to operate. Our company has an exclusive Chevrolet fleet. We have found that Chevrolet will stand the rough service required of a truck in oil field work."

Everywhere in America today, you'll find Chevrolet truck owners echoing Mr. Elkins' words . . . saying, in effect, "Chevy puts more money in my pocket!" An Illinois drilling contractor, for example, Mr. C. E. Brehm of Mt. Vernon, states:

"We have nine Chevrolet trucks in use . . . have been using Chevrolets for six years and

CHEVROLET **NEW CHEVROLET**

Anything less is an

TO BUY AND...THEY ECONOMICAL TO OPERATE!"

have bought five of the new heavy-duty 1956 models. We use Chevrolets because of their low operating costs, availability of service, low initial expense, and the men say they are easy to drive. We're particularly happy with the new Triple-Torque Tandem heavy-duty model we bought to assist us in our oil well maintenance. For a big truck, it's sure easy to move in and out of the fields."

Reports such as these offer proof of the low-cost, high-powered performance a new Chevrolet heavy-duty model will bring to *your* operation. Why not see your Chevrolet dealer soon? . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

***Modern features* make new Chevrolet trucks the Performance Champs of the Heavyweight Class!**

- **New** short-stroke 195-hp Loadmaster V8 powers Chevrolet top-tonnage trucks!
- **New Powermatic*** — the first automatic transmission designed specially for big trucks . . . thoroughly proved for safer, easier operation!
- **New** Triple-Torque Tandems hike G.V.W.'s to 32,000 lbs., G.C.W.'s to 50,000 lbs.!
- **Spicer** 5-speed transmission† for extra pulling power, improved economy.

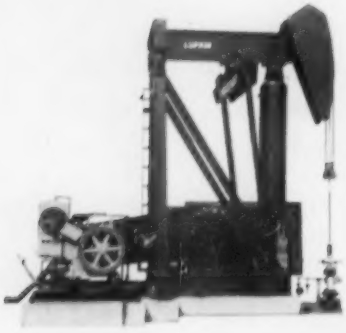
**Optional at extra cost.*
†Optional, extra cost, Series 9000-10000 models.

TASK·FORCE TRUCKS

old-fashioned truck!

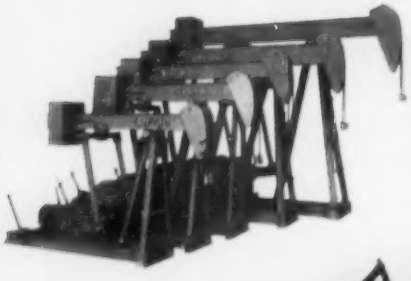
LUFKIN Presents...

THE ABC's OF ECONOMICAL PRODUCTION



A AIR BALANCED UNITS

For compactness, light weight and ease of installation. Available in sizes ranging from 80,000 in. lbs. peak torque and 19,000 lbs. polished rod capacity to the mighty A-912DA-192-42 with 912,000 in. lbs. peak torque, 192 inch stroke and 42,000 lbs. polished rod capacity.



B BEAM BALANCED UNITS

Where economy is an important factor and dependability a prime consideration. Sizes from the B-10D-20-4 with 10,000 in. lbs. peak torque and 4,000 lbs. polished rod capacity to the B-57D-42-10.5A with 57,000 lbs. peak torque and 10,500 lbs. polished rod capacity.

C CRANK BALANCED UNITS

The all purpose unit known the world over for its ruggedness, trouble-free performance, and low cost maintenance. Sizes from the C-25D-24-6 with 25,000 in. lbs. peak torque and 6,000 lbs. polished rod capacity to the C-912DA-168-30 with 912,000 in. lbs. peak torque and 30,000 lbs. polished rod capacity.

Plus... LONG STROKE HYDRAULIC UNITS

For deeper wells and heavier fluid loads where high rod stresses are encountered. Rod life is greatly increased by this unit's slow, cushioned reversals and uniform polished rod velocity which avoids high peak loads. Available in 35,000 lbs. polished rod capacity and 20 ft., 25 ft., and 30 ft. stroke lengths.

Lufkin FOUNDRY & MACHINE COMPANY

LUFKIN, TEXAS

Branch Sales and Service: Houston • Dallas • New York • Tulsa • Los Angeles • Seminole • Oklahoma City • Corpus Christi • Odessa
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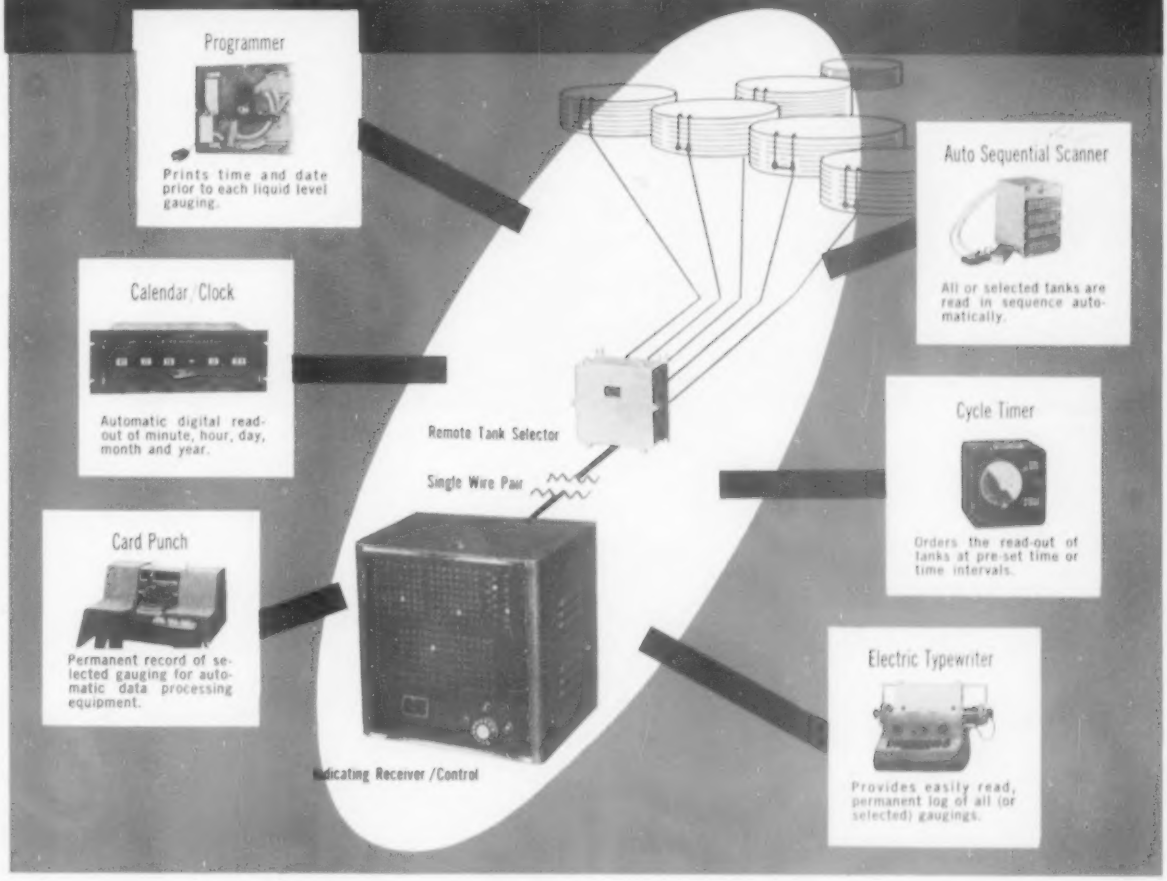
Lufkin equipment in Canada is handled by THE LUFKIN MACHINE CO., LTD., 9950 65th Avenue, Edmonton, Alberta, Canada
3913 18th Avenue, Regina, Saskatchewan, Canada

Bendix-Pacific ELECTRO-SPAN

GIVES YOU THE MOST VERSATILE TANK GAUGING SYSTEM


Programmer
Prints time and date prior to each liquid level gauging.
Calendar / Clock
Automatic digital read-out of minute, hour, day, month and year.
Card Punch
Permanent record of selected gauging for automatic data processing equipment.
Auto Sequential Scanner
All or selected tanks are read in sequence automatically.
Cycle Timer
Orders the read-out of tanks at pre-set time or time intervals.
Electric Typewriter
Provides easily read, permanent log of all (or selected) gaugings.
Remote Tank Selector
Single Wire Pair
Indicating Receiver / Control

With Electro-Span Gauging Systems you can secure *any* arrangement of a basic system — together with a unique selection of input and readout equipment — to meet virtually every requirement.

The Eectro-Span System is an inexpensive digital pulse-code system for the measurement and control of any number of tanks. Tank levels to ⅛", and averaging temperatures if desired, are displayed on lamp registers.

In addition, all of the important accessories shown above can be provided to give you the most complete tank gauging system available today.

Write Pacific Division, Bendix Aviation Corp., Department 832, North Hollywood, Calif., for Bulletin ES-5A or contact Instruments, Inc., P.O. Box 556, Tulsa, Oklahoma.

Bendix
PACIFIC DIVISION
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NORTH HOLLYWOOD, CALIF.

Export—Bendix International: 205 E. 42nd St., New York 17

Canadian—Computing Devices of Canada, Ltd., P.O. Box 508, Ottawa 4

Inside story:

Valves may look alike on the surface. Their performance is another story. And the inside story of Powell Valves is that *every* Powell Valve has *Performance Verified.*

X-ray and gamma ray inspection—examining the very structure of the metal itself—are two of the many ways that Powell can make absolutely certain that Powell Valves will give *dependable* flow control.

Every part of every valve must pass rigid inspection. As a final step in manufacture, every Powell Valve is subjected to *an actual line test.* Because of Powell's pains-taking quality control, valve repair is cut to the minimum and plant shut down through valve failure is substantially reduced. Records from refineries, power and industrial plants the world over prove it.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our COMPLETE *quality line* which has PERFORMANCE VERIFIED.

The Wm. Powell Company, Cincinnati 22, Ohio . . . 110th YEAR

PERFORMANCE PV VERIFIED

FIG. 1503—150-Pound Steel Gate Valve.

FIG. 6003—Steel Gate Valve for 600 Pounds W.S.P.

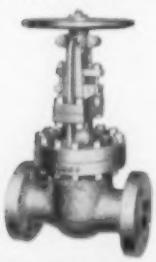
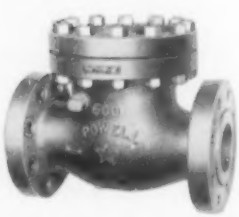


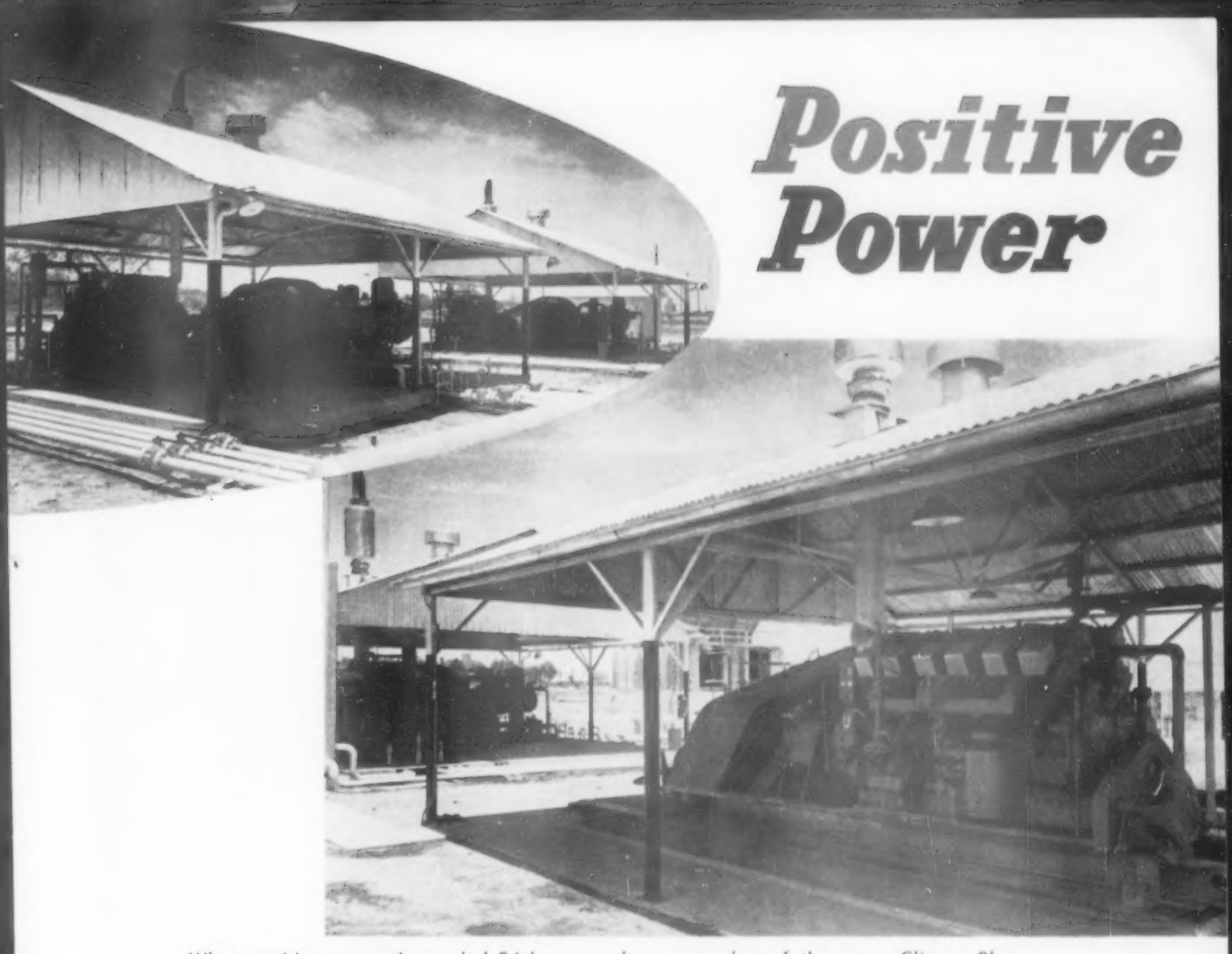
FIG. 6061—600-Pound Steel Swing Check Valve.



POWELL VALVES

BRONZE, IRON, STEEL AND CORROSION RESISTANT VALVES.

Positive Power

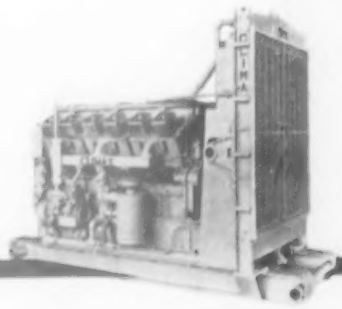


When positive power is needed 24 hours a day every day of the year, Climax Blue Streak Engines deserve first consideration. Dependability, economy, and a well established reputation have brought Climax Engines to their present leading position as power suppliers for oil and gas installations. The two Climax V-122's shown above are each driving a compressor for Republic Natural Gas Co. on their O'Connor lease, producing 1,500,000 cubic feet of gas per day, every day. On the coast, in the mountains, or on the plains, you'll see these Climax Blue Streak Engines operating efficiently throughout the oil country.

Get all the facts on Climax Oil Field Engines from your nearby distributor today.

WHERE POWER IS YOUR PROBLEM CLIMAX IS THE ANSWER.

climax BLUE STREAK ENGINES



CLIMAX ENGINE AND PUMP MFG. CO.

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FACTORY
CLINTON, IOWA

DISTRICT OFFICE
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General Diesel and Equipment Company
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Wilson's Engine & Equipment Co.
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Stewart & Stevenson Services, Inc.
Houston and 5 Texas Branches

Cullander Machinery Co.
Belzoni, Miss. & West Memphis, Ark.

Tobin Machinery Co.
Lafayette, La.

Vern Walton Co.,
Coolidge, Casa Grande & Marana, Ariz.

Landes, Zachary and Peterson
Denver, Colo.
and 5 Branches

United Power, Inc.
(Formerly United Tool Co.)
Shreveport & Alexandria, Louisiana

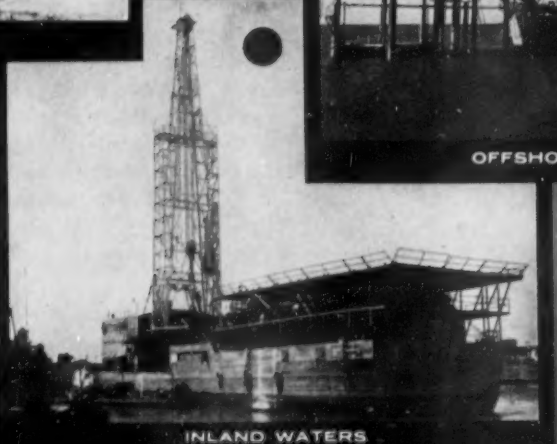
PENROD RIGS

MAKE HOLE
FASTER AND ***CHEAPER***
IN ANY DRILLING PROGRAM

No matter what depth or location your program calls for, Penrod has the equipment, the skilled men, the experience, to offer you big savings.

ON LAND

OFFSHORE



INLAND WATERS

MODERN EQUIPMENT – LATEST METHODS

THOROUGHLY EXPERIENCED ORGANIZATION

INDIVIDUAL SUPERVISION OF EACH RIG

2-WAY RADIO ON ALL EQUIPMENT

MODERN HOUSING FOR OPERATING PERSONNEL

HIGH PRESSURE PUMPS ON ALL RIGS

USE OF MAXIMUM DRILL COLLAR WEIGHT

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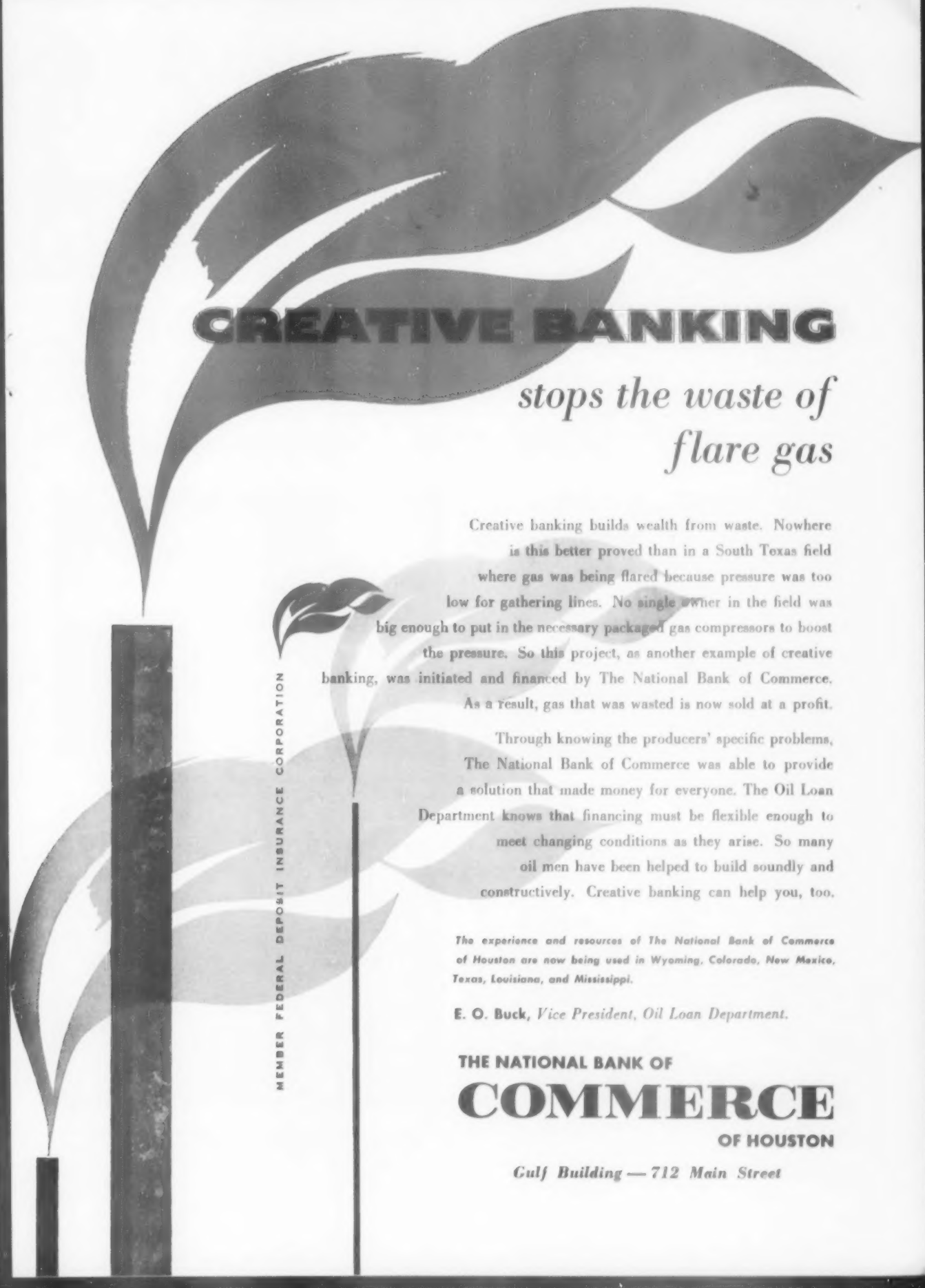
PENROD DRILLING COMPANY

D. K. (DEWEY) DAVIS, DRILLING SUPERINTENDENT

TELEPHONE 3-1601

418 MARKET STREET SHREVEPORT, LOUISIANA



CREATIVE BANKING

stops the waste of flare gas

Creative banking builds wealth from waste. Nowhere is this better proved than in a South Texas field where gas was being flared because pressure was too low for gathering lines. No single owner in the field was big enough to put in the necessary packaged gas compressors to boost the pressure. So this project, as another example of creative banking, was initiated and financed by The National Bank of Commerce. As a result, gas that was wasted is now sold at a profit.

Through knowing the producers' specific problems, The National Bank of Commerce was able to provide a solution that made money for everyone. The Oil Loan Department knows that financing must be flexible enough to meet changing conditions as they arise. So many oil men have been helped to build soundly and constructively. Creative banking can help you, too.

The experience and resources of The National Bank of Commerce of Houston are now being used in Wyoming, Colorado, New Mexico, Texas, Louisiana, and Mississippi.

E. O. Buck, *Vice President, Oil Loan Department.*

THE NATIONAL BANK OF

COMMERCE

OF HOUSTON

Gulf Building — 712 Main Street

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

International Power Unit *ordered, equipped, delivered and*

LOS ANGELES, CALIF. An International Power Unit was ordered, equipped to meet customer's specifications, delivered, and "on pump" in a short, *perhaps record-breaking, 5½ hours, here, recently.*

The complete transaction took place when one of Atlantic Oil Company's wells on Terminal Island in the Los Angeles Harbor District "came in" late on the evening before. The power unit was ordered from a nearby International Power Unit Distributor, at 9:30 a.m. The unit was ready for delivery from the distributor at 11:30, after specified equipment had been added.

At 12:10 p.m., the unit arrived at the well site, 12 miles away. Final installation, including a running check on natural gas, required only three hours. Then the unit was on duty at 3:00 p.m....a mere 5½ hours from the time of the phone call.

The following pictures tell the complete story:

Phone call for the International U-164 is made at 9:30 a.m., to distributor sales manager.

Meeting installation requirements, distributor mechanic adds equipment for low-cost natural gas pumping of 3700-foot well.

Engine is lowered onto foundation, where mechanics quickly go to work bolting it down.

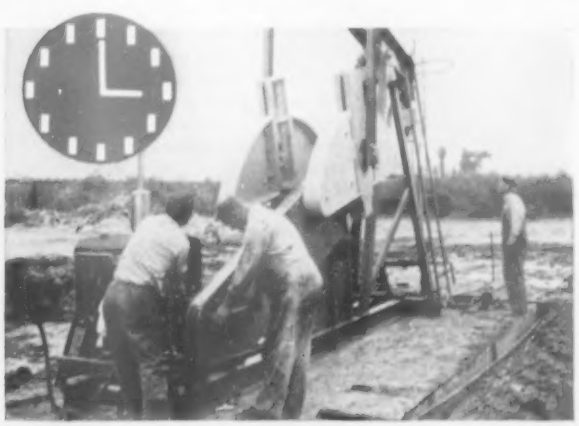
With engine in place, distributor representative and customer production foreman check installation before proceeding with pulley, belt, and guard.

"ON PUMP" in 5½ hours!

...it's typical of the on-the-spot oil field service you get from your International Distributor!

Two hours after call, engine, ready for duty, is loaded onto distributor's waiting service truck.

Well site, 12 miles away, was reached at 12:10 p.m., and engine is quickly unloaded.



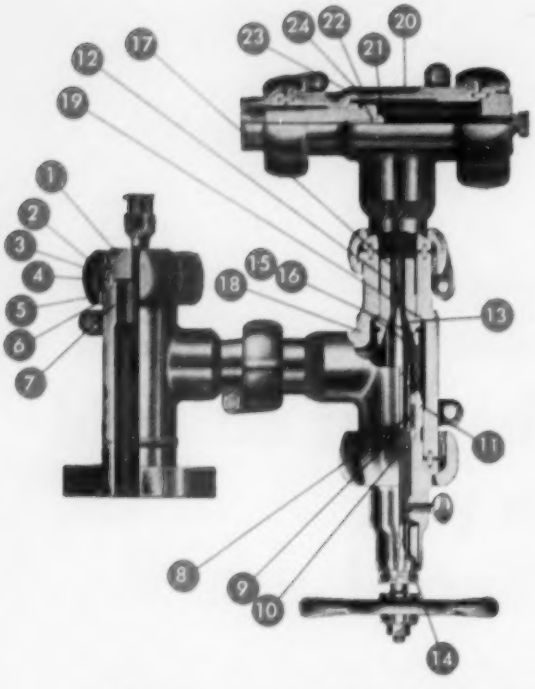
A little before 3 p.m., mechanics make final adjustments, put belt guard in place. Engine begins delivering oil at 3 p.m., 5½ hours after first phone call!

On-the-spot service like this is typical of "on-their-toes" International Distributors you'll find near your oil or gas jobs. Your International Power Unit Distributor offers a complete line of International engines—famous for long life, dependability, and next-to-nothing maintenance costs—plus complete parts and service. Your International Construction Equipment distributors offer you 7 job-proved International crawlers ranging from 41.5 to 161 dhp, with a wide choice of attachments.

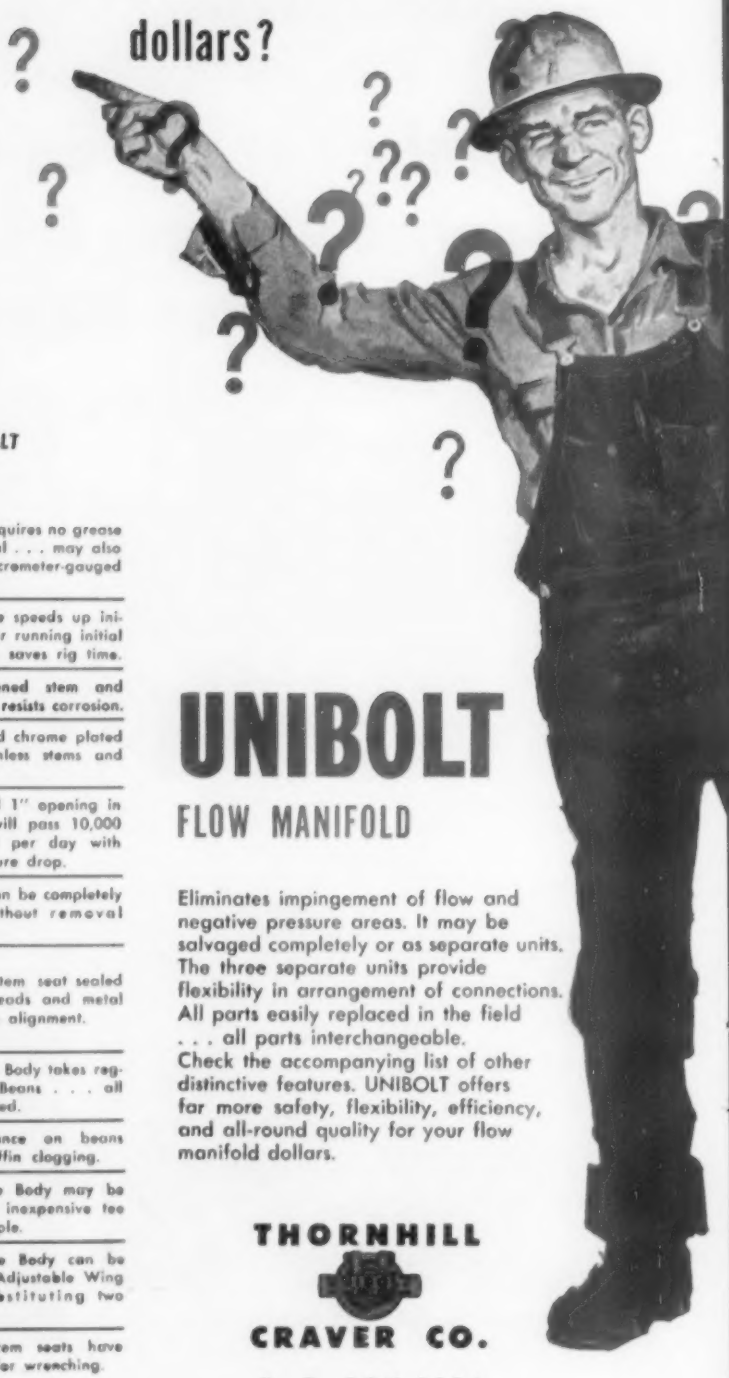
INTERNATIONAL® CONSTRUCTION EQUIPMENT

International Harvester Company
180 North Michigan Avenue, Chicago 1, Illinois

A COMPLETE POWER PACKAGE INCLUDING: Crawler, Wheel, and Pipe-Boom Tractors . . . Self-Propelled Scrapers and Bottom-Dumps . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Trucks . . . Diesel and Carbureted Engines . . . Motor Trucks.



Are you getting all of these important features for your flow manifold dollars?



These are the "Extras" that make UNIBOLT the best buy of all manifolds

1	Tee cannot be accidentally opened.	13	Wing Valve requires no grease to effect a seal . . . may also be used as micrometer-gauged flow bean.
2	No exposed threads . . . no accidental damage.	14	Variable choke speeds up initial clean-up or running initial flow tests . . . saves rig time.
3	Concealed seat in groove . . . no accidental damage.	15	Nitride hardened stem and stem seat . . . resists corrosion.
4	All metal seat . . . not affected by high or low temperature.	16	Choice of hard chrome plated or "SA" stainless stems and seats.
5	Lubricators, bottom hole pressure adapters, and valves easily attached to Unibolt connection.	17	Unrestricted 1" opening in Wing Valve will pass 10,000 bbls. of fluid per day with 100 lbs. pressure drop.
6	2"—3000 lb. wp Unibolt 28% stronger than 2" — ser. 900 flange.	18	Wing Valve can be completely overhauled without removal from tree.
7	Unibolt stronger than tubing threads . . . ideal for working trees with welded lift nipple. Tubing threads in tee if desired.	19	Wing Valve stem seat sealed by power threads and metal gasket assures alignment.
8	Stem packing needs no tightening.	20	Positive Choke Body takes regular or "X" Beans . . . all beans flow-rated.
9	Stem turns freely under high pressures.	21	Shaped entrance on beans prevents paraffin clogging.
10	Threads on stem not exposed to external or internal damage.	22	Positive Choke Body may be replaced with inexpensive tee and cage nipple.
11	Full 2½" pilot for true stem alignment and rigidity.	23	Positive Choke Body can be converted to Adjustable Wing Valve by substituting two parts.
12	Streamlined flow — no obstructions . . . no turbulence.	24	Beans and stem seats have external hex for wrenching.

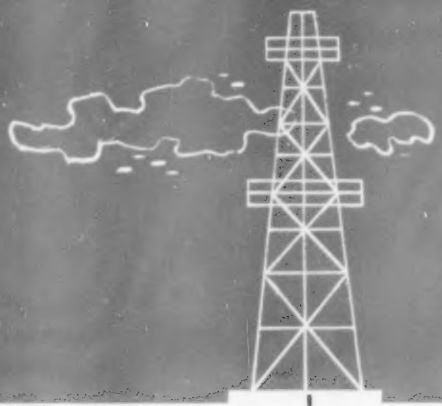
UNIBOLT

FLOW MANIFOLD

Eliminates impingement of flow and negative pressure areas. It may be salvaged completely or as separate units. The three separate units provide flexibility in arrangement of connections. All parts easily replaced in the field . . . all parts interchangeable. Check the accompanying list of other distinctive features. UNIBOLT offers far more safety, flexibility, efficiency, and all-round quality for your flow manifold dollars.

THORNHILL CRAVER CO.

P. O. BOX 1184
HOUSTON, TEXAS



$50,000.00 hangs by a thread!

Fifty thousand dollars worth of drill pipe, tool joints, and drill collars!

Technically, not just one thread, but—in the American Iron Straight Grip—a combination of precision-engineered threads and shrink seals which make the most efficient shrink type tool joint in operation today!

Tests have proven that STRAIGHT GRIP tool joints are 3 times as strong as the pipe they connect!

You may be assured that with STRAIGHT GRIP tool joints on your drill pipe, your string will "hang together" under the most severe drilling conditions.

AMERICAN IRON & MACHINE WORKS CO., INC.
MANUFACTURERS OF A OIL FIELD EQUIPMENT
OKLAHOMA CITY

SPECIFY

AMERICAN IRON *Straight Grip* TOOL JOINTS

Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY, New York

Canada's first

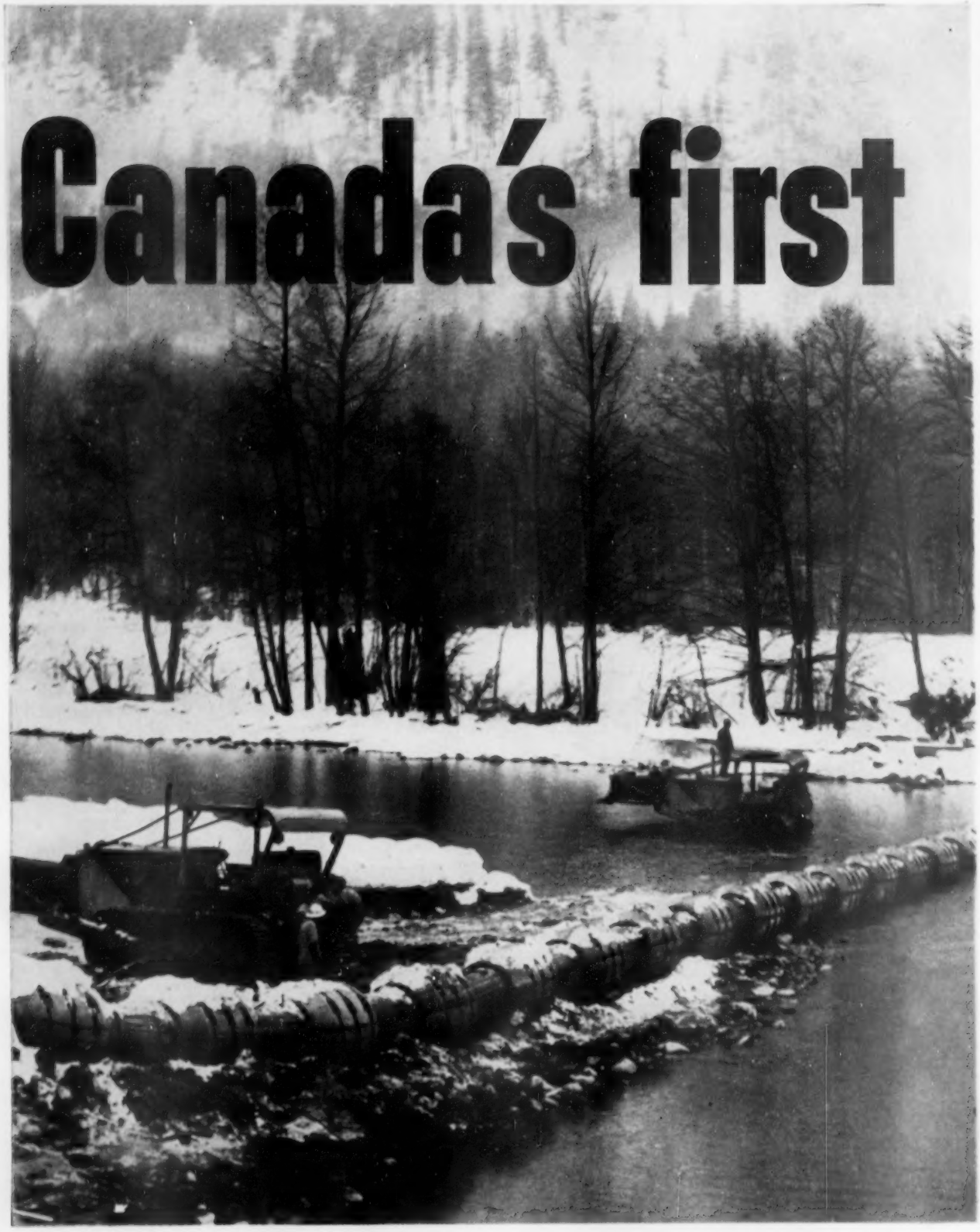


Photo shows the crossing of the Coquihalla River near Hope, British Columbia. The 30-inch diameter pipe is loaded with river weights and laid in a ditch beneath the river bed with eight feet of cover. Some of the river crossings, like this, were intentionally made during the winter when the water was at its lowest level.

"BIG INCH"

Kick-off for the line was at Huntington, B.C. Linkup with Pacific Northwest Pipelines is a short distance east of Vancouver. Westcoast has been authorized to draw gas from more than 42 million acres in the Peace River section in Alberta and British Columbia.

Westcoast Transmission Company, Limited, lays natural gas pipelines which will link British Columbia and New Mexico

TO tap the prolific gas resources of northeastern British Columbia and northwestern Alberta, Westcoast Transmission Company is now laying a 30-inch pipeline from the fields, almost due south to the international border near Vancouver. The line will provide natural gas for British Columbia and Pacific Coast States, the latter through a linkup with Pacific Northwest Pipeline Corporation which is currently completing a pipeline from New Mexico to the Northwest area.

Westcoast Transmission's 688-mile main line will have a maximum capacity of 660 million cubic feet per day and its completion will mark the first large-scale interchange of natural gas between western Canada's new and expanding fields and United States markets. Canadian Bechtel Limited are managers of engineering and construction for the project.

Marks first deliveries of 30-inch pipe from A. O. Smith Milwaukee plant

Approximately 22% of the 30-inch pipe used by Westcoast Transmission was shipped to the job from A. O. Smith's Milwaukee pipe mill. It was the first pipe of this size produced in the Milwaukee pipe mills' new facilities.

For almost 30 years . . .

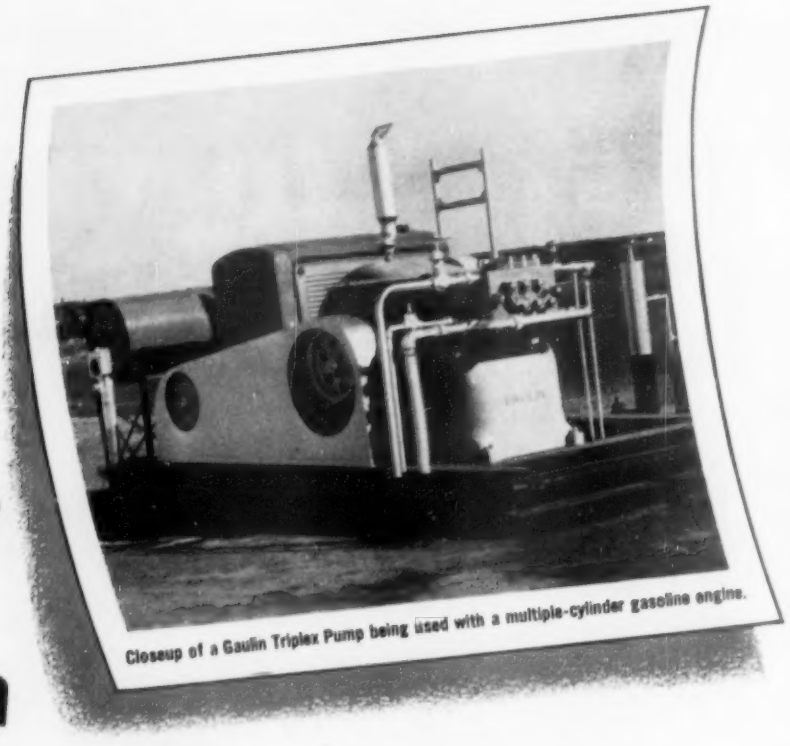
A. O. Smith line pipe has always been manufactured to a high standard of quality . . . precisely controlled at every step of production. That's why A. O. Smith pipe, made and installed in 1928, is still in operation. That's why so much A. O. Smith pipe is in nearly every important high-pressure line.

Through research A.O. Smith *. . . a better way*

A.O.Smith
CORPORATION

TUBULAR PRODUCTS DIVISION
Milwaukee 1, Wisconsin

Chicago 4 • Dallas 2 • Los Angeles 17 • Midland 5, Texas • New Orleans 12
New York 17 • Pittsburgh 19 • San Francisco 4 • Seattle 1 • Tulsa 3 • Washington 6, D.C.
International Division: Milwaukee 1, Wisconsin



Closeup of a Gaulin Triplex Pump being used with a multiple-cylinder gasoline engine.

Month after Month, You know a GAULIN TRIPLEX PUMP

Surface Power Unit for Subsurface Hydraulic Pumping will keep on producing . . .

Write today — at no obligation — for your copy of the booklet that describes all of these Gaulin features:

Horizontal Design of power unit completely separates cylinder from crankcase, preventing any product leakage to crankcase. Cylinder assembly may be taken apart in minutes. Just lift cover and all parts instantly accessible for inspection or repair.

Plexiglas Well Covers give instant visual check of plunger and packing condition.

Corrosion-Proof Cylinder is made of stainless. Hardened stainless or ceramic plungers available.

Spring-Loaded Plunger packing is self-adjusting, self-sealing, eliminates the human element.

API Ball Valves and removable seats permit easy replacement in the field.

Wide Capacity and Pressure range easily, economically obtained by changing plunger size in the field.

CALL: **SPECIALTY SALES & SERVICE, INC.**
TULSA, OKLAHOMA—(TULSA LUther 4-2236) ODESSA, TEXAS—(ODESSA 6-0921)

MANTON-GAULIN MANUFACTURING CO., INC.
LA HABRA, CALIFORNIA
M. LES WALRAVEN, MGR. OIL FIELD SALES (OXFORD 7-6334) (LONG BEACH 4-1596)

MANUFACTURED BY
MANTON-GAULIN
MANUFACTURING CO., INC.
73 GARDEN ST., EVERETT, MASSACHUSETTS

Gaulin

SUPPLY *can give your oil a real*

LIFT!

J&L Supply men from the Gulf of Mexico into Canada and from the Rocky Mountains east keep a vigilant eye on producing wells. This has been going on for over fifty years.

Cabot units expertly engineered to fit your wells put J&L men on your team. They never lose interest. Field service shops in the United States and Canada never close.

For the best in pumping units—for immediate service — for seasoned advice, call your local J&L Supply store today! You will find it listed in the yellow pages of your phone book.

CABOT ADJUSTABLE-CRANK Series structure capacities are from 7,000 to 32,000 pounds maximum polish rod load. The flood lubricated Sykes-cut herringbone gears are rated (API) from 40,000 to 456,000 inch-pounds. ILLUSTRATED HERE: Upper right, AC15-114D, polish rod 15,000; peak torque 114,000. Upper left, AC13-114D, polish rod 13,000; peak torque 114,000. Lower left, AC9-40D, polish rod 9,000; peak torque 40,000.

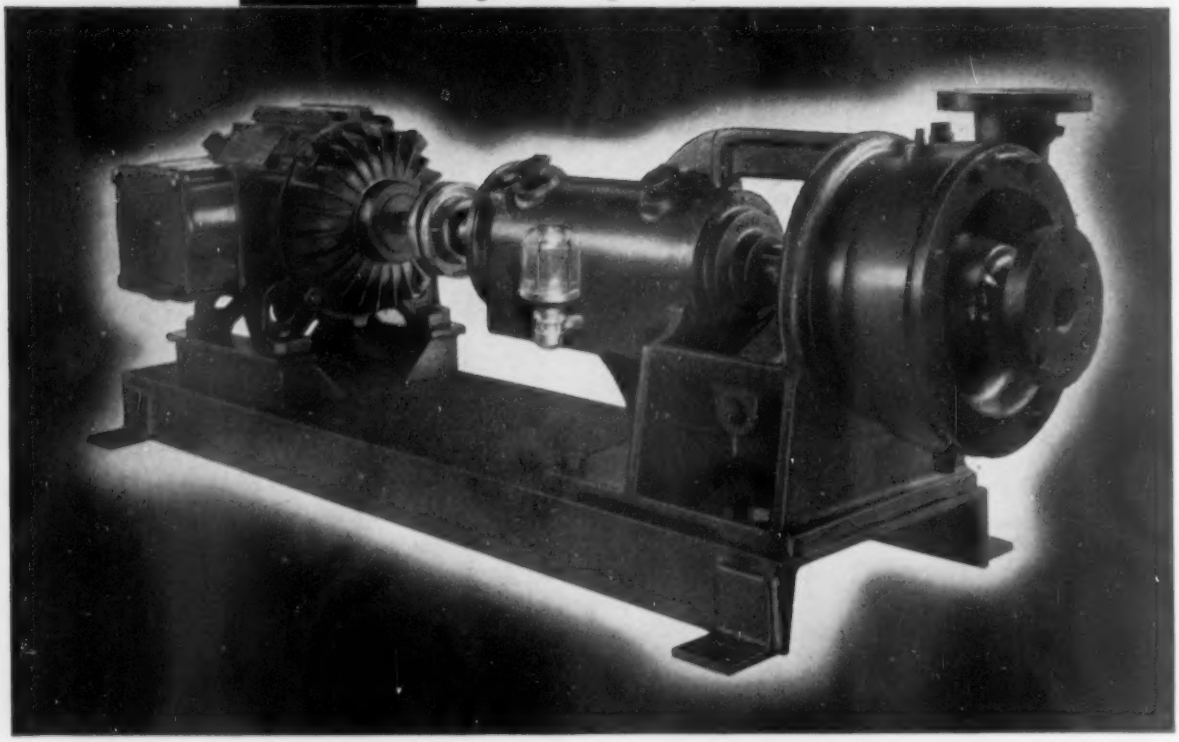
Jones & Laughlin

SUPPLY DIVISION – Tulsa

SERVING THE UNITED STATES AND CANADA

12M

There's **MORE** Engineering help from Allis-Chalmers



Get modifications you need

with Allis-Chalmers FRAME-MOUNTED PUMPS

EXACT MECHANICAL MODIFICATIONS . . . right combination of materials...all are designed into the Allis-Chalmers pump *you* need to get lowest cost per gallon pumped. With a wide variety of optional constructions available, A-C pump specialists can build *your* pump to do any one of many refinery jobs.

Costs Less, Too

Despite custom design, the Allis-Chalmers pump costs hundreds of dollars less than costly "special" refinery pumps. Find out about its many possible applications and check these custom features:

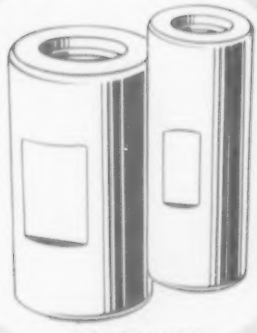
- Available materials include iron, bronze, stainless steel, high nickel alloys and others.
- Variety of sealing arrangements are available — external seal, external grease seal, water-cooled stuffing box, single inside mechanical seal, single outside mechanical seal, double inside mechanical seal.
- Shaft is made of either high-grade carbon steel or stainless steel. Shaft sleeve is furnished in bronze or a special material — according to your requirements.

Allis-Chalmers can supply a complete pumping unit — pump, motor, drive, and control. For more information, contact your nearby A-C district office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

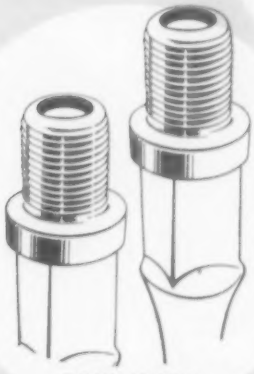
A-4996

ALLIS-CHALMERS

SUCKER RODS



COUPLINGS



PONY RODS
POLISHED RODS

FOREMOST IN QUALITY

For over 60 years, Jones has been so closely identified with every advance in design, manufacture and performance of sucker rod strings, it is only natural that the industry looks to Jones for the ultimate in quality and service.

JONES
SUCKER RODS

Look for the "GREEN" Rods

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PARTNERS IN PETROLEUM PROGRESS

THE S. M. JONES COMPANY
Division of Buffalo-Eclipse Corporation

General Office and Factory: **TOLEDO, OHIO**
Sales Office: Kennedy Building, **TULSA, OKLAHOMA**
Export Sales Representatives: IDECO—Division of Dresser Equipment Company, Republic National Bank Building, Dallas, Texas and Chanin Building, New York City

WATCH CLOSELY...THE PERFORMANCE RECORD

in **BLACK** and WHITE

WHITE MAGIC

TOPS THEM ALL FOR TOP-HOLE DRILLING

Here's Why:

WHITE MAGIC is non-fluorescent . . . makes black-light formation inspection more accurate.

WHITE MAGIC contains no soap-type emulsifiers. It is chemically stable under conditions of use.

WHITE MAGIC allows mud in which it is used to be easily converted to a lime base.

WHITE MAGIC needs no caustic to activate it and make it effective.

WHITE MAGIC performs equally well at any pH.

WHITE MAGIC does not ferment. No preservatives are necessary and chemical maintenance costs are greatly reduced.

WHITE MAGIC is an excellent thinner for water base muds. It is very effective in reducing the viscosity and lowering gel strength of clay water muds, particularly where the water base mud may be contaminated by cement.

WHITE MAGIC emulsifier is not affected by mud contaminants such as shale, cement, limestone, anhydrite, gypsum, etc.

If you go by the record . . . and aren't swayed by opinion or hearsay . . . you can add up the advantages you gain and the money you save in BLACK and WHITE, when you start with WHITE MAGIC and complete with BLACK MAGIC. Ask your nearest OBI representative for proof.

OIL BASE, INC.

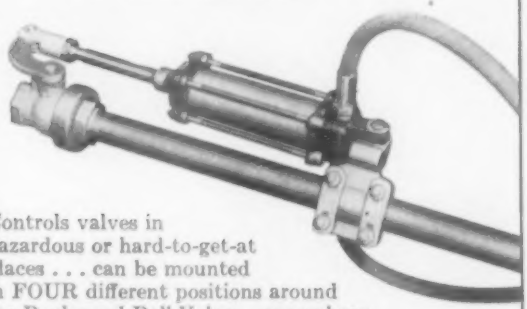
PLANTS IN: Houston • Odessa • Duncan • Bakersfield • Compton
BRANCHES IN: Houston • Odessa • Corpus Christi • Oklahoma City • Duncan • Lafayette • Harvey • Bakersfield • Long Beach • Ventura
REPRESENTATIVES IN: Mexico City • Caracas • Lima • Bogota • Calgary • Paris. CABLE ADDRESS: OBI

Rockwood Ball Valves

- *Full round pipe size flow*
- *Leakproof service*
- *¼ turn opening and closing*
- *No maintenance*

Air-Operated Ball Valves

For remote control use

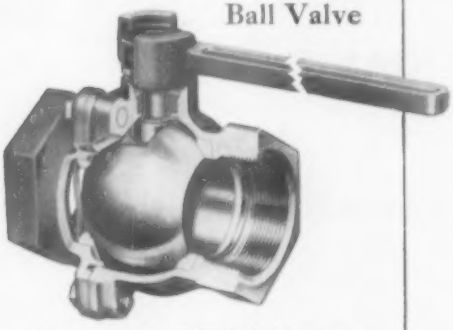


Controls valves in hazardous or hard-to-get-at places . . . can be mounted in FOUR different positions around the Rockwood Ball Valve...several can be controlled from one control board...available in a complete package unit from your distributor.

Male Thread Bronze Ball Valve

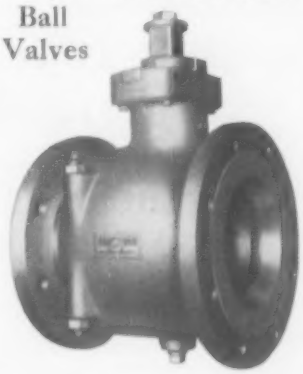
Full flow . . . with thread end, flanged end, union end or combination of same available with this valve. Longer life . . . greater strength. Size 2½" only.

Steam Ball Valve

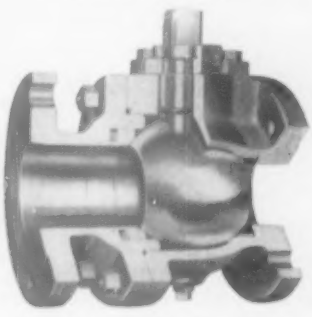


New Rockwood Ball Valve for use with steam handles up to 125 pounds of steam per square inch and 350 degrees F, with ease . . . opens and closes quickly. Pipe sizes ⅜" to 2".

6" and 8" Cast Steel Ball Valves



3" and 4" Cast Steel Ball Valves



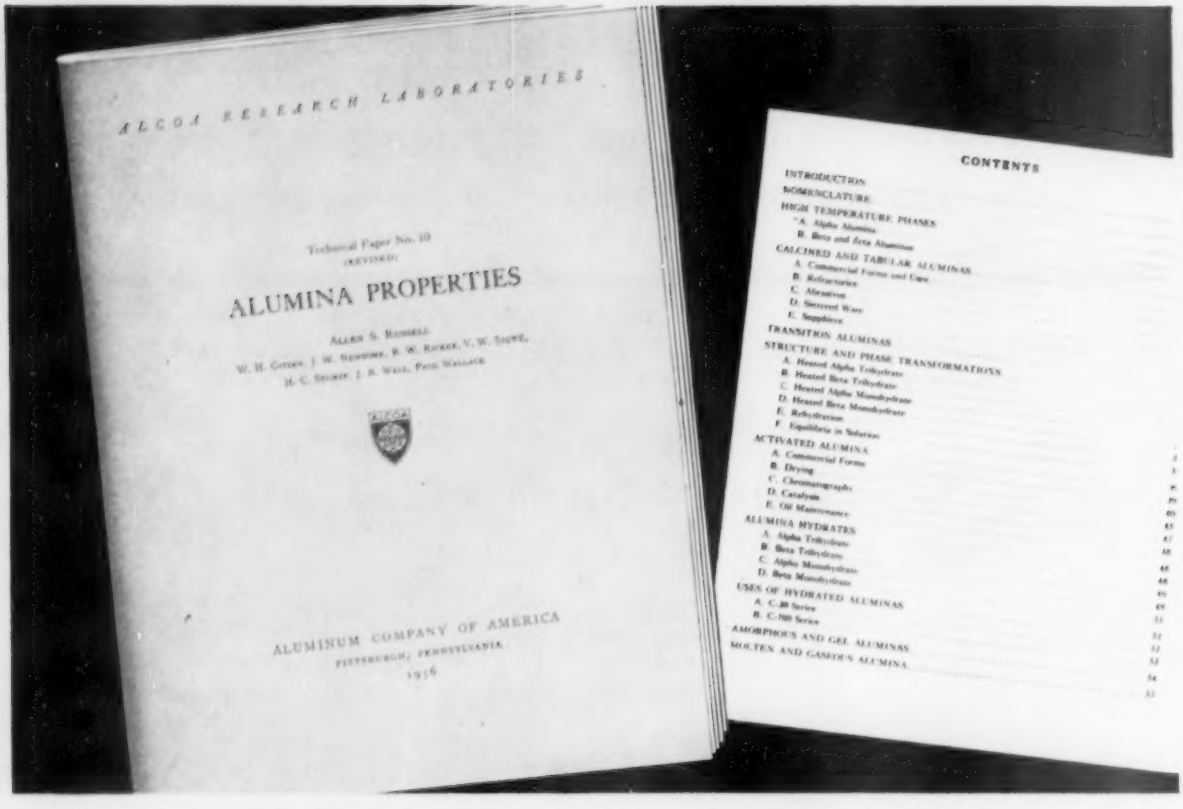
Combines best features of plug cocks, gate and globe valves . . . made of medium carbon cast steel that meets specifications for carbon steel pressure castings as embodied in ASTM. Also made in other materials.

ROCKWOOD BALL VALVES

Write for complete data to Rockwood Sprinkler Company, 1264 Harlow St., Worcester 5, Mass. Distributors in all principal industrial areas.

ROCKWOOD

Tested and listed by Underwriters' Laboratories, Inc.



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Here is the most complete technical reference work available on the commercial forms and uses of ALCOA® Aluminas. It is the manual, *Alumina Properties*, by ALCOA . . . the world's first and leading producer of commercial aluminas.

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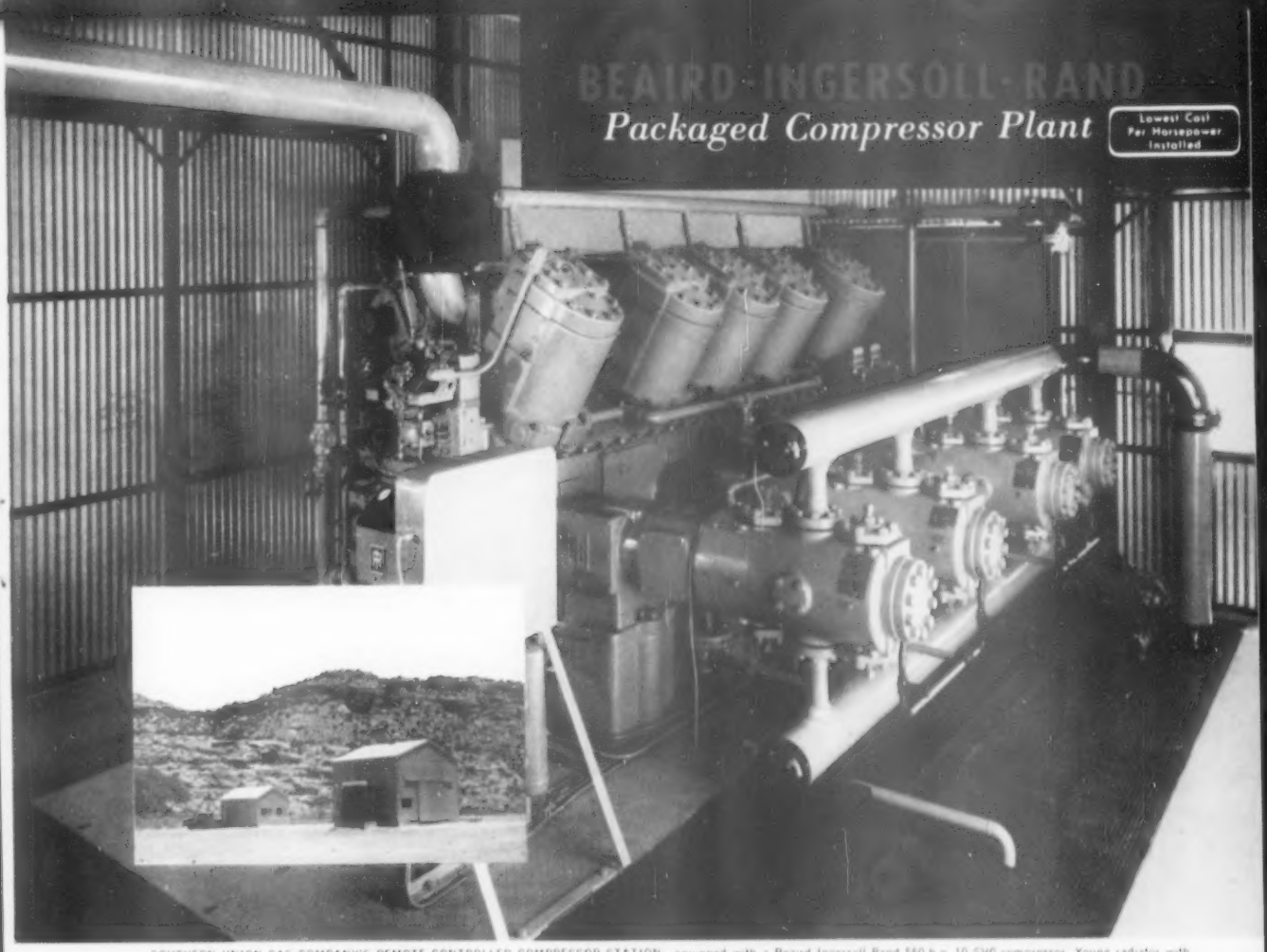
Lowest Cost Per Horsepower Installed



SOUTHERN UNION GAS COMPANY'S REMOTE CONTROLLED COMPRESSOR STATION—equipped with a Beaird-Ingersoll-Rand 550 h.p. 10 SVG compressor. Young radiator with lubricating oil cooler and gas coolers, and all necessary controls for unattended operation. Other sizes 110 to 660 h.p.

Southern Union Gas Company's Dogie Compressor station in El Largo Canyon, New Mexico, is more than 20 miles from the nearest paved highway and many miles farther from the nearest town. To boost gas from this lonely site Southern Union has installed a Beaird-Ingersoll-Rand 550 hp. 10 SVG packaged compressor.

Part of a 500-well gathering system, the Dogie Station compressor uses one stage of compression to pick up gas from 20 wells in nearby Ballard Field and boost it from 250 psig. to 500 psig. for delivery to the main line.

Normally inspected once a day, the station has been designed to overcome potential isolation caused by roads made impassable by deep snow, rain, swollen rivers and washes during severe San Juan winters. This problem of isolation has been solved by equipping the compressor with automatic controls and shut down devices that stand by day and night to protect the station and plant should any unusual operating condition occur. Now on a 40-hour weekly maintenance schedule, the station is capable of long periods of completely unattended operation.

Let us show you how a Beaird-Ingersoll-Rand packaged compressor plant can be designed to meet your special operating requirements.

Packaged Compressor for —

REMOTE CONTROLLED CANYON LOCATION

BEAIRD MACHINING MANUFACTURING STEEL WAREHOUSE

THE J. B. BEAIRD COMPANY, INC.

PACKAGED COMPRESSOR PLANTS

CAST STEEL FITTINGS

PRESSURE BULK STORAGE

ANHYDROUS AMMONIA EQUIPMENT

LP-GAS SYSTEMS

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ARMCO **welded steel pipe**

Cuts line pipe costs 3 ways

1

LONG, UNIFORM LENGTHS

Uniform, 50-foot lengths mean fewer joints, less assembly, and easy, accurate computation of joints required.

2

CHOICE OF 20 DIAMETERS

Wide range of diameters makes it unnecessary to buy more capacity than needed.

3

CHOICE OF 10 WALL THICKNESSES

You select the right wall thicknesses for the job without buying costly and useless extra metal.

Use Armco Welded Steel Pipe for requirements in the Natural Gasoline and Natural Gas Divisions and wherever else you need dependable line pipe. Write for more data. Armco Drainage & Metal Products, Inc., Welded Pipe Sales Division, 4396 Curtis Street, Middletown, Ohio. 201 KOME Building, Tulsa, Oklahoma. Subsidiary of Armco Steel Corporation. Export: The Armco International Corporation.

ARMCO®

PACKAGED TOWER POWER

"Power comes in one piece" on a Marley cooling tower—a completely integrated unit that consists of motor, drive shaft, couplings, Geareducer* and fan hub, assembled and permanently aligned on a rugged unitized steel support.

Every component of this packaged power unit (except the motor of your choice) is Marley-designed and manufactured exclusively and specifically for cooling tower use. Each is engineered for individual mechanical excellence and for functional integration into the complete assembly. All are backed by a single responsibility for dependable performance and economical maintenance, and that backing is the Marley guarantee.

These units are standard for all Marley industrial towers and, together with Marley multi-blade aluminum fans, are available for modernization of towers of any make. Installing the pre-assembled Marley power package for replacement service reduces shut-down time by days.

For detailed information on "packaged power" for new or existing towers, call the Marley sales engineer in any of 55 major cities.

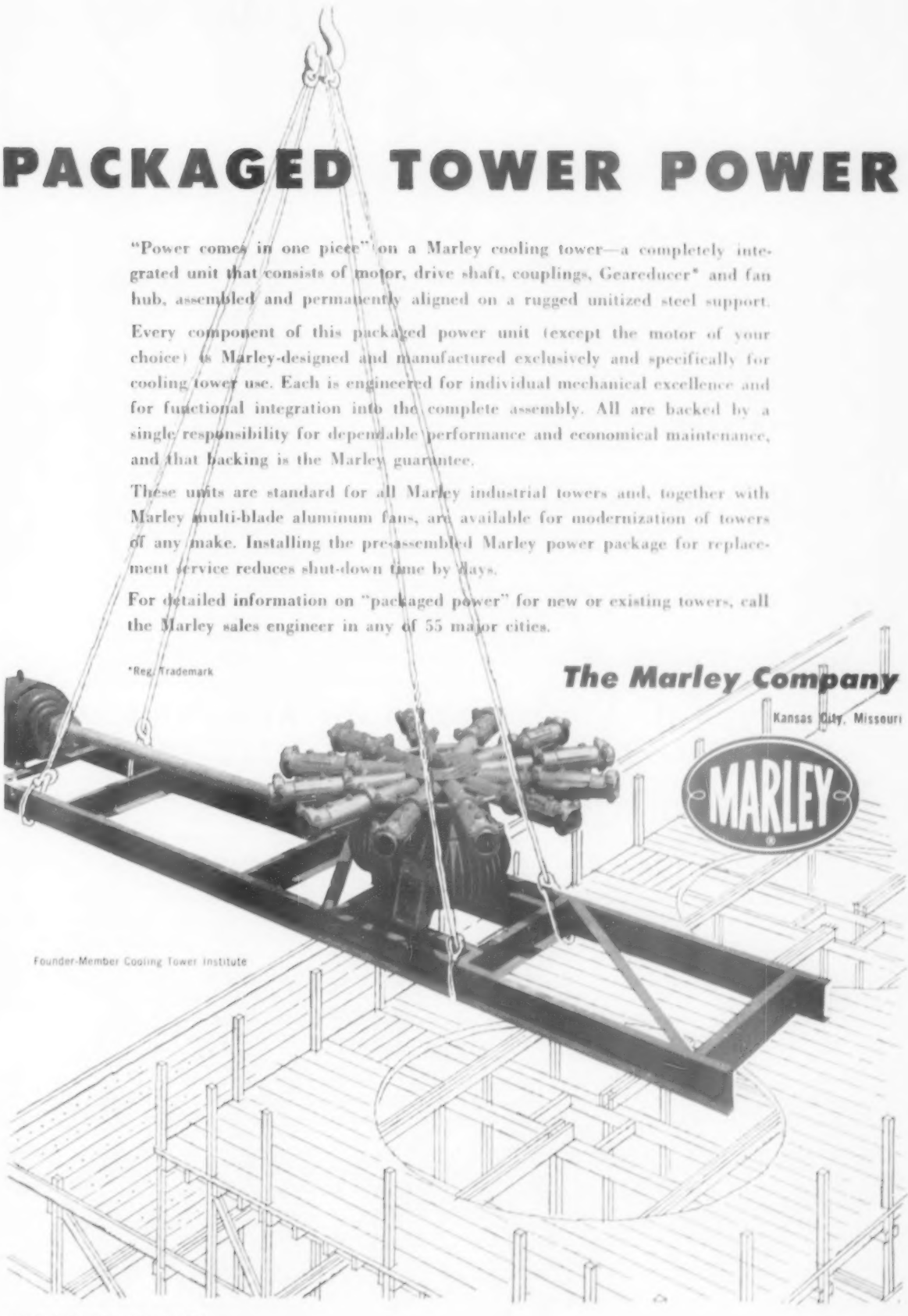
*Reg. Trademark

The Marley Company

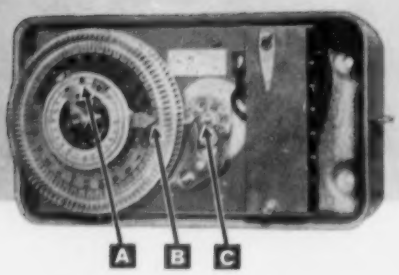
Kansas City, Missouri

MARLEY

Founder-Member Cooling Tower Institute



SET IT—LOCK IT—FORGET IT



NEW CUTLER-HAMMER SUPERTIMER

This advanced-designed, rugged program timer is the heart of automatic pumping.

A Sets the precise restarting time delay from zero to 180 seconds. This is exclusive with the Supertimer—random starts or coincidental starts of even two pumps are impossible.

B Sets the daily pumping schedule—pull a tab for each fifteen minutes of pumping, space them through the daily 24 hour period as desired.

C Sets the weekly pumping schedule—1, 2, 3, 4, 5, 6 or 7 days per week as desired.

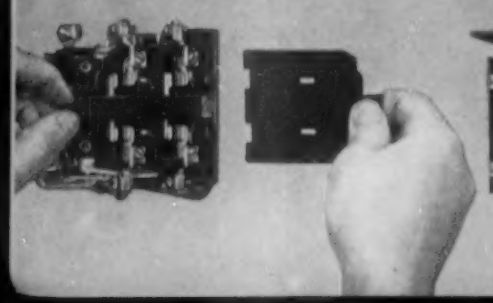
Cutler-Hammer Three-Star Oil Well Pumping Control Brings Full Automation to Oil Well Pumping

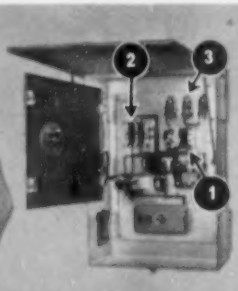
Nothing is left to chance . . . Cutler-Hammer Three-Star Oil Well Pumping Control is so completely automatic and so completely dependable, it can be relied upon to pump your wells indefinitely on a pre-set schedule without attention as far as the electrical equipment is concerned. Astonishing? Yes. Exaggerated? No. The Cutler-Hammer Three-Star Oil Well Pumping Control will out-perform, out-protect, out-last, and serve better than all others. This is *automation* in action. You pre-set the pumping schedule and the control does the rest. It starts, stops, restarts and cycles *indefinitely* according to the pre-set Supertimer. It provides complete protection with 3 coil overload relays, advanced-designed lightning arresters and full dependability of contactor performance. And C-H three-star control stays on the job. Blistering heat, ice, bugs or dust hold no terror for this control. This control has *everything* particularly the engineered dependability so vital in any automation . . . nothing is left to chance. For the finest, insist on Cutler-Hammer.

CUTLER-HAMMER ☆ ☆ ☆ MOTOR CONTROL C-H

Your nearby Authorized Cutler-Hammer Distributor is stocked and ready to serve you. Order from him today. CUTLER-HAMMER, Inc., 1453 St. Paul Ave., Milwaukee 1, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ontario.

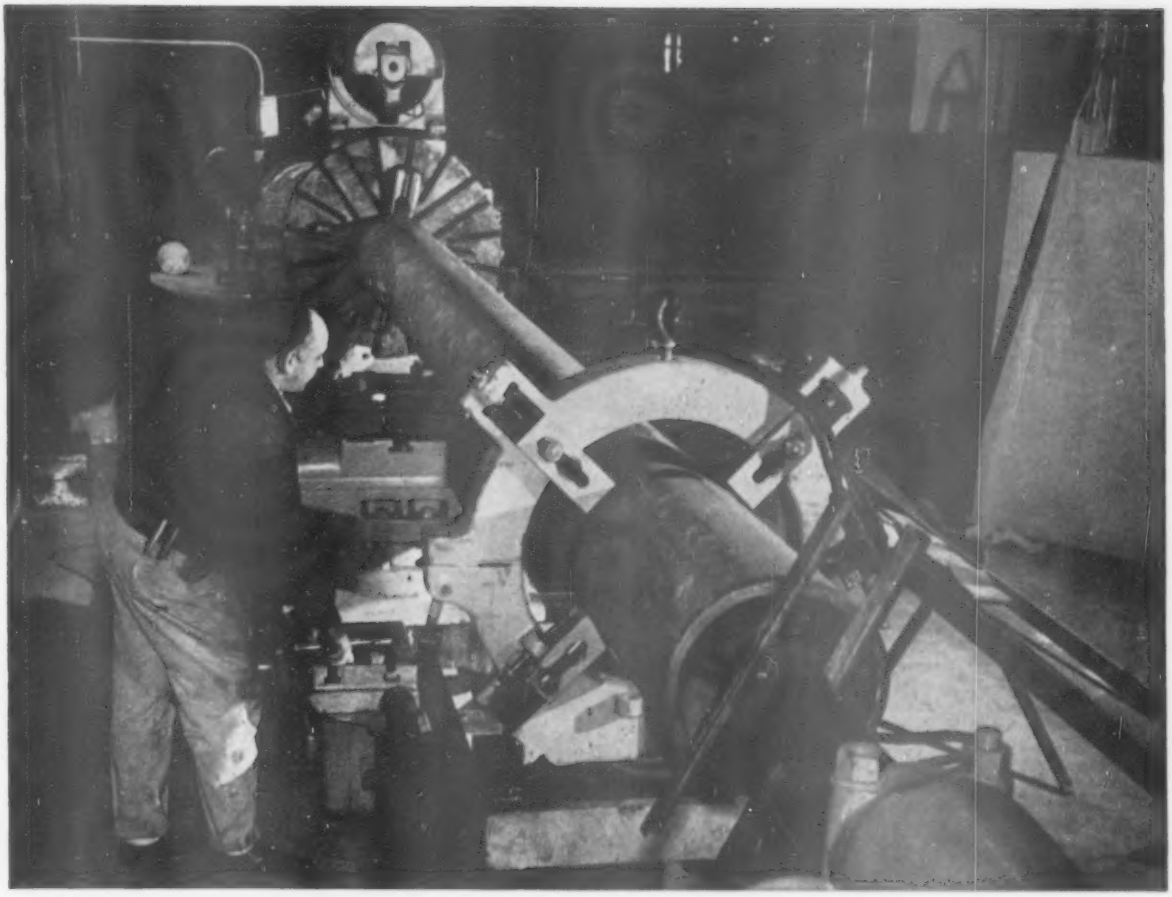
DUST-SAFE CONTACTS—Dust, the greatest menace to oil field equipment, can't settle on the vertical contacts of the Cutler-Hammer Three-Star Oil Well Pumping Control and interrupt service. C-H vertical contacts provide cleaner, cooler, smoother operation and eliminate contact maintenance when properly rated.





PLUS Many Important Features of Design

1. Contactor type disconnect switch with visible vertical dust-safe contacts.
2. Spring type fuse receiver with constant contact pressure fuse clips.
3. Advanced-designed lightning arresters—safety plus for electrical equipment and personnel.
4. Inner door mounted selector switch permits manual operation for set up and pump maintenance and automatic operation for normal pumping.
5. Chimney draft enclosure design keeps the control cool—no nuisance tripping from trapped heat.



ALCO FACILITIES ASSURE VALUE IN PREFABRICATED PIPE

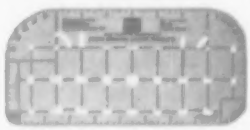
Machines and Methods at ALCO's Plant Handle All Sizes of Seamless Pipe, Any Alloy or Grade; Modern Welding Techniques Used for All Materials.

ALCO brings to prefabricated pipe production a modern plant, completely equipped with machine tools to handle any size, alloy or technique. Facilities include large lathes *(above)*, other heavy machine tools, induction heat-treating for joint preheat and stress relief after welding.

Advanced quality control methods are another important factor in ALCO prefabricated pipe. Use of X-ray machines and cobalt 60 pills to test welds is an example of up-to-date inspection and test procedures.

Experience and production know-how are also factors in ALCO prefabricated pipe. Pipe manufacture draws on welding techniques which have placed ALCO in a leading position in the welding field. ALCO's experience in heat-exchange equipment, both refinery and power plant, aids in piping manufacture.

Your inquiries on ALCO piping will receive prompt handling at any ALCO Sales Office, or, if you wish, write P. O. Box 1065, Schenectady 1, N. Y.



Information on how to obtain the ALCO piping drawing layout template, a definite aid in making piping layouts, is available from ALCO, P. O. Box 1065, Schenectady 1, N. Y.

ALCO

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Look for this honored Name Plate . . .

STEAM GENERATORS by Vogt

a guide to advanced designs in package unit and custom built steam generating equipment

Vogt steam generating units are available in types and sizes to meet individual plant needs for power, processing or heating.

Package units range from 10,000 to 40,000 pounds of steam per hour while custom built units are obtainable in the larger capacities. Available in bent tube types and straight tube, forged steel sectional header types for solid, liquid or gaseous fuels burned singly or in combination.

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Box 1918, Louisville 1, Kentucky

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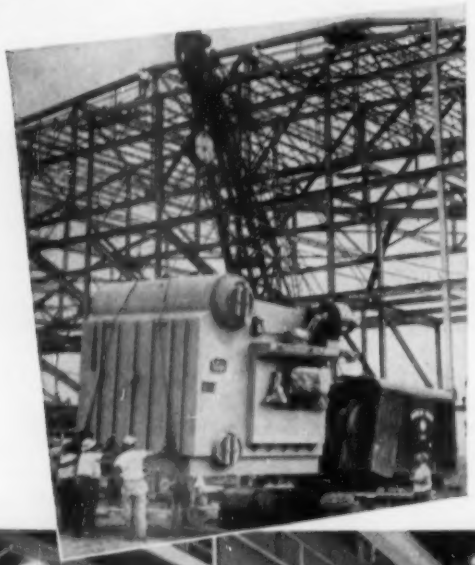
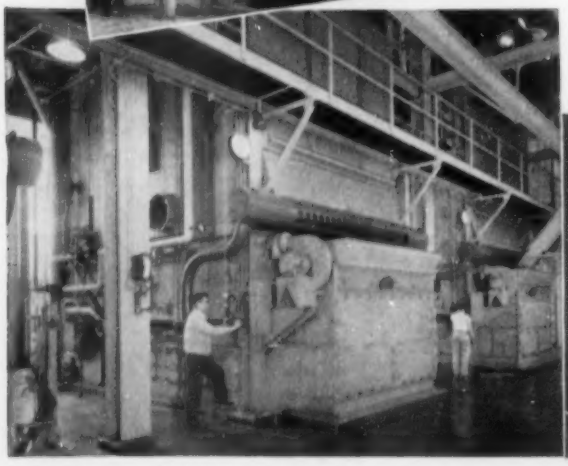




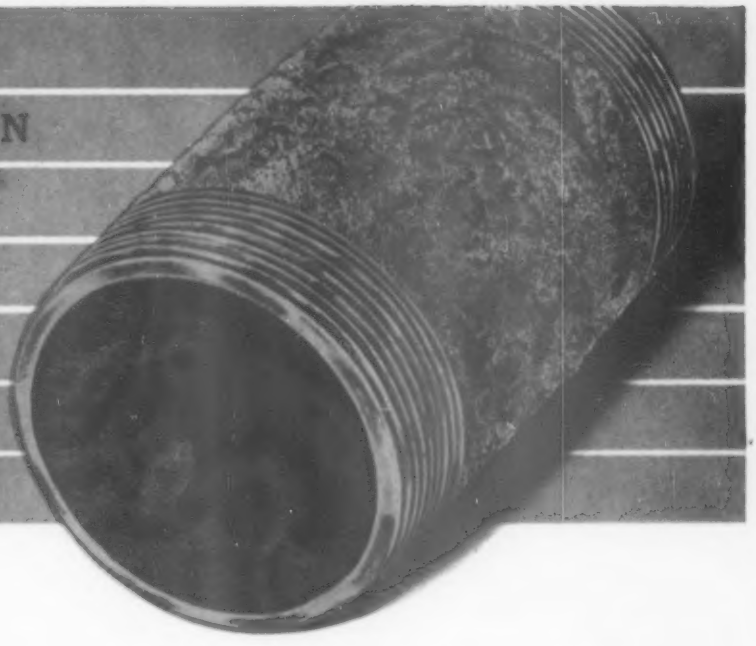
One of three 15,000 #/hr. capacity package unit steam generators for a State institution.

Two of three 41,000 #/hr. steam generators installed in Medical Center Steam Plant, Louisville, Ky.

Erecting two 50,000 #/hr. steam generators at Kelly Air Force Base, San Antonio, Texas.

OTHER VOGT PRODUCTS
Drop Forged Steel Valves, Fittings and Flanges in a complete range of sizes • Petroleum Refinery and Chemical Plant Equipment • Steam Generators • Heat Exchangers • Ice Making & Refrigerating Equipment

IS PARAFFIN SQUEEZING YOUR PROFITS?



INSIST ON SOUTHWESTERN PLASTIC PIPE

With today's rising production costs . . . can you afford to let paraffin build-up cut your profits. Southwestern Tenite Butyrate Plastic Pipe has been installed in many troublesome paraffin areas and has helped solve the paraffin build-up problem.

The metal pipe shown in this illustration is typical of lines that become plugged in from three to six months. Southwestern Tenite Butyrate Plastic lines in the same areas have remained trouble-free for almost two years.

Can you afford to use any pipe but Southwestern? Get the facts. Mail the coupon today.

- WILL NOT CORRODE
- REDUCED PARAFFIN BUILD-UP
- LIGHTWEIGHT
- ECONOMICAL INSTALLATION

SOUTHWESTERN PLASTIC PIPE CO.

P. O. Box 117 • Mineral Wells, Texas • Phone 2050

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We are interested in Plastic Pipe for use in _____

In this application, temperature will be about _____

with pressures of _____

☐ Have Someone call on us ☐ Send Free Literature

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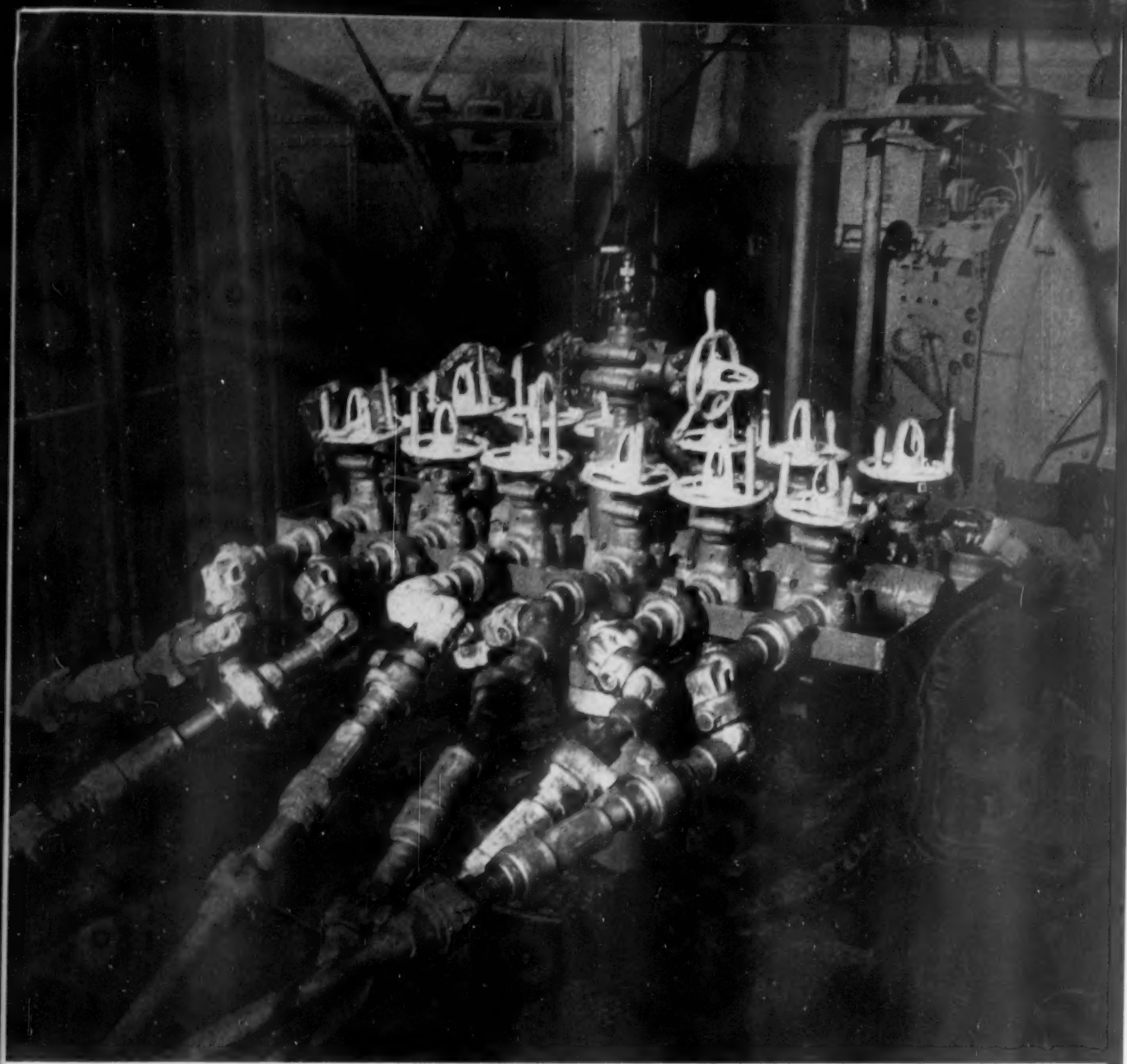


Why Flex-Seal For Fracing?

Because it is the one mud valve that will take high-pressure, high-volume, high-abrasive flow and still seal tightly!

Look for the roughest jobs of all. There you'll find Cameron Flex-Seals. Take formation fracturing for example. The Flex-Seal valves in the fracing manifold pictured above handled 75,000 gallons of heavily sand-laden frac fluid under 4800 psi injection pressure. The all-time record frac job—250,000 gallons of water carrying 200,000 pounds of sand, injected in high volume with 3400 psi—was accomplished recently thru a Flex-Seal manifold.

Cementing pump trucks, blowout preventer choke manifolds, slush pump relief lines . . . these are typical of the severe services where Flex-Seals also shine. Regular mud line service is a snap for these rugged valves.

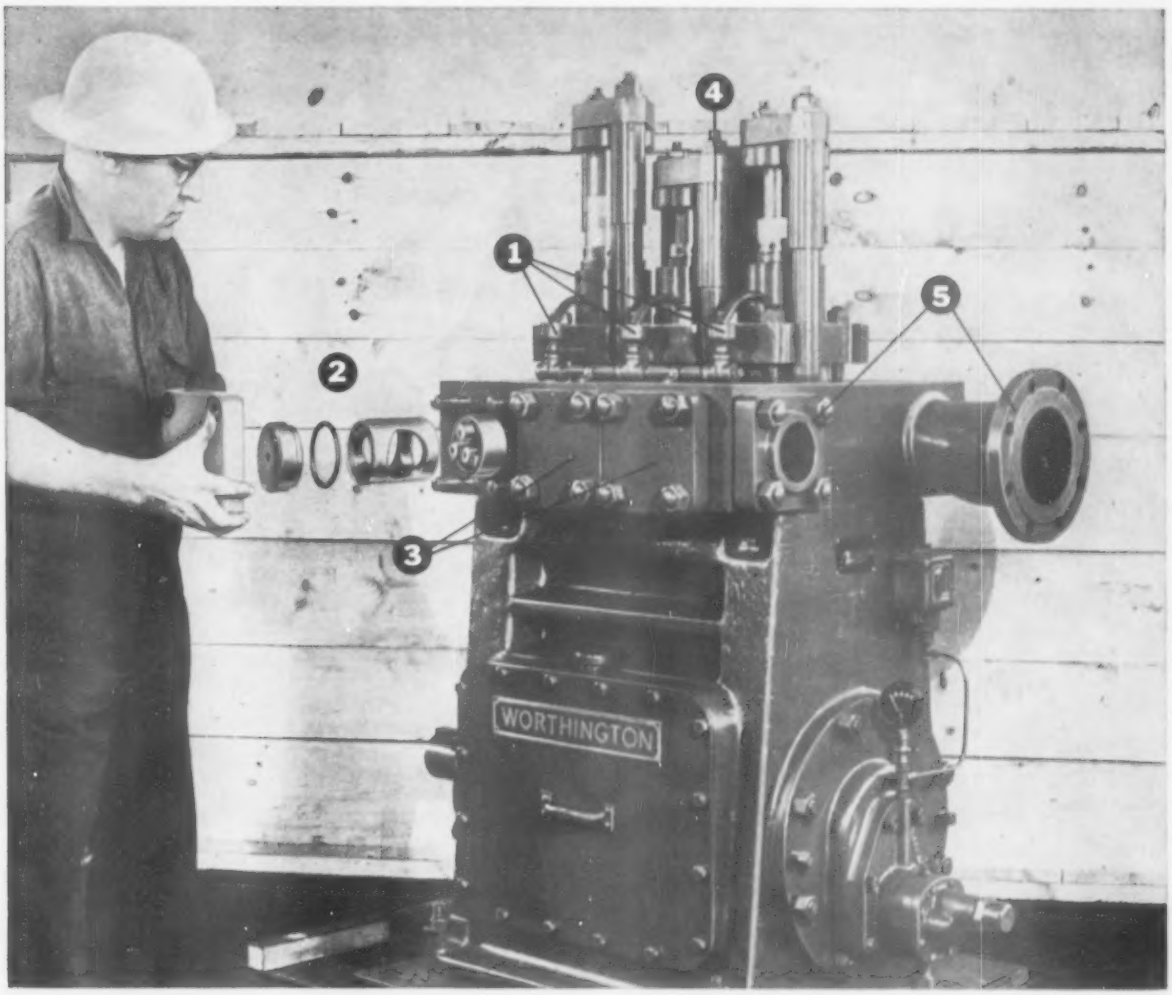
Flex-Seals seldom need major repairs. An occasional inexpensive replacement part, which can be installed by the drilling crew with ordinary tools, is usually all that's required to keep Flex-Seals in tip-top operating condition.

Cameron

IRON WORKS, INC.

P. O. Box 1212 · Houston, Texas

Export Office: 7912 Empire State Bldg., New York City. In England: Cameron Iron Works Ltd. Time & Life Bldg., New Bond Street, London W. 1 England.



Check These 5 Waterflood Pump Features

Compare with any other! Operates for years at peak efficiency; easy to work on in the field.

Men who run waterflooding operations say the ideal pump should be (1) rugged—to operate continuously for five to ten years, (2) dependable—for peak efficiency and (3) highly accessible—for fast maintenance.

See for yourself how Worthington's waterflood pump—with five exclusive features—measures up.

It licks corrosion. Barrels are protected by exclusive feature #1—*separate drains* which carry off stuffing box leakage and prevent it from accumulating on cylinders. The cylinder is made of forged steel (or aluminum bronze) which is rugged enough to stand up for years under corrosive oil field salt water, regardless of pressure.

A Worthington pump is dependable for peak waterflood efficiency. It will run at reasonably low suction heads without rough or noisy operation because of feature #2, *double ported valves* which give greater flow through a given seat diameter.

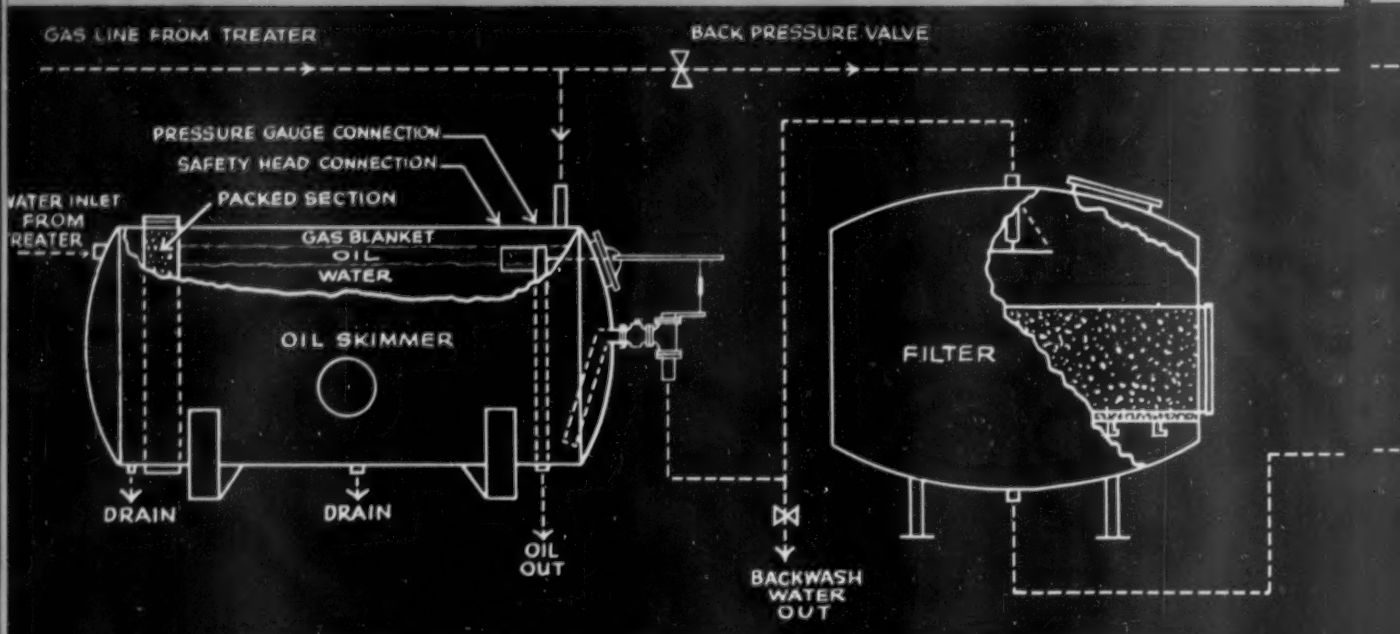
And it's easy to work on in the field. *Individual valve covers*, feature #3, permit you to inspect and service valves in half the time (without breaking pipe connections). *Interchangeable stuffing box barrels*, feature #4, let you change pump capacity in less than an hour. *Flanged suction and discharge* openings, feature #5, make piping easy to connect or disassemble.

Add them up. For a rugged, dependable, accessible waterflood pump, your choice has to be . . . Worthington! Get the full story from your nearest Worthington District Office, or write to Section P61, Worthington Corporation, Harrison, N. J.

P-61

WORTHINGTON

For The Preconditioning Of Subsurface



FLOW DIAGRAM OF BS&B AQUA-KLEENER SYSTEM

There Is No Better Equipment Than BS&B

Conditions under which water conditioning and filtering systems must operate vary widely from one water flood project to the next. The degree of water treatment required will depend on the condition of the produced water and the characteristics of the formation into which the water is to be injected. That is why the new BS&B AQUA-KLEENER is today's *outstanding* water conditioning and filtering system for use on water flood projects!

AQUA-KLEENER is a closed type system which prevents air from contacting the water —thereby minimizing corrosion, excluding air-borne bacteria and preventing the oxidation of such substances as soluble iron.

The AQUA-KLEENER System consists basically of a primary separating unit, an oil skimmer, separate filter and backwash water tank (or a combination of the two), and auxiliary controls and equipment. Its *design flexibility* enables you to use it as a complete water conditioning system—or to employ only parts of it to augment an existing installation.

The "heart" of the AQUA-KLEENER System is an improved type filter using porous aluminum oxide underdrain plates under a filter bed of Anthrafilt No. 1. In comparative tests, this type of filter has been found to be greatly superior to the graded bed filters of sand and gravel commonly used in other systems, as shown by the following:

EFFICIENCY
OVER 60 YEARS
BS&B
RELIABILITY
ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

BLACK, SIVALLS

Oil & Gas Equipment Division, Dept. 1-A9A

Injection Water On Water Flood Projects...

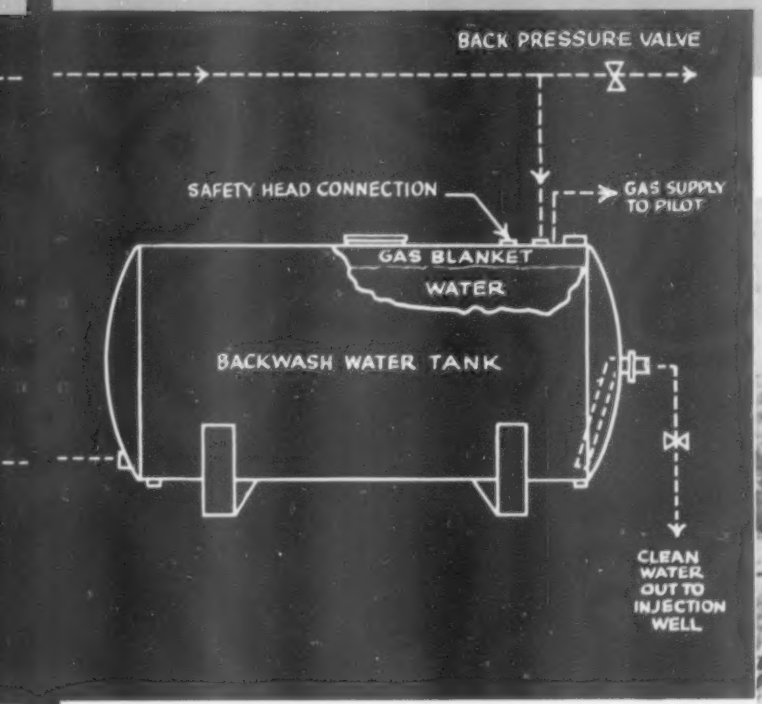


Photo shows BS&B AQUA-KLEENER System with oil skimmer at left, "Filta-Wash" (combination filter and backwash water tank) in center, and storage tanks at right. Pump house is in the background.

AQUA-Kleener!*

- Filter runs are longer before backwashing is necessary.
- Only half as much backwash water is required for cleaning.
- Filter material weighs approximately one-half as much.
- Filter material does not react with alkaline water, algae, bacteria or such dissolved substances as soluble iron.
- Filter bed does not pack as tightly, therefore resulting in a lower pressure drop.
- Higher porosity and greater surface area of filter material results in more efficient removal of turbidity and bacteria.

If you'd like more detailed information on the new BS&B AQUA-KLEENER System, contact your nearest BS&B Representative — or write to us direct.

* AQUA-KLEENER is a trade name of Black, Sivalls & Bryson, Inc.

& BRYSON, INC.

1708 West Main Street Oklahoma City, Oklahoma

Now...a New advance in...

Gauge Safety!

Another step ahead in Marsh Gauges: the new Marsh "Safecase". Down to the final detail this gauge is developed for those applications where an unexpected surge of heavy, explosive over-pressure can occur.

In the "Safecase" a solid metal barrier protects the entire face. But, still more important, the *entire back* of the gauge is a thin, ductile plate, designed to open out when subjected to abnormal pressure. Back plate is held firmly to the case by two holding screws and cannot be dislodged by a pressure blowout.

In exhaustive tests it has never been possible to shatter the crystal or create any other dangerous condition in a "Safecase" gauge with its safety-release back. The accompanying illustration shows the result of one of a series of tests in which blank cartridges were fired in the back of the case without even breaking the crystal. Think what that means in safety to operating men!

Yes, an important development . . . but merely the kind you would expect from the manufacturer who originated the "Connoweld" tube, the "Marshalloy" case, the Mastergauge movement and practically all of the major advancements in pressure gauges. Ask for up-to-the-minute information.

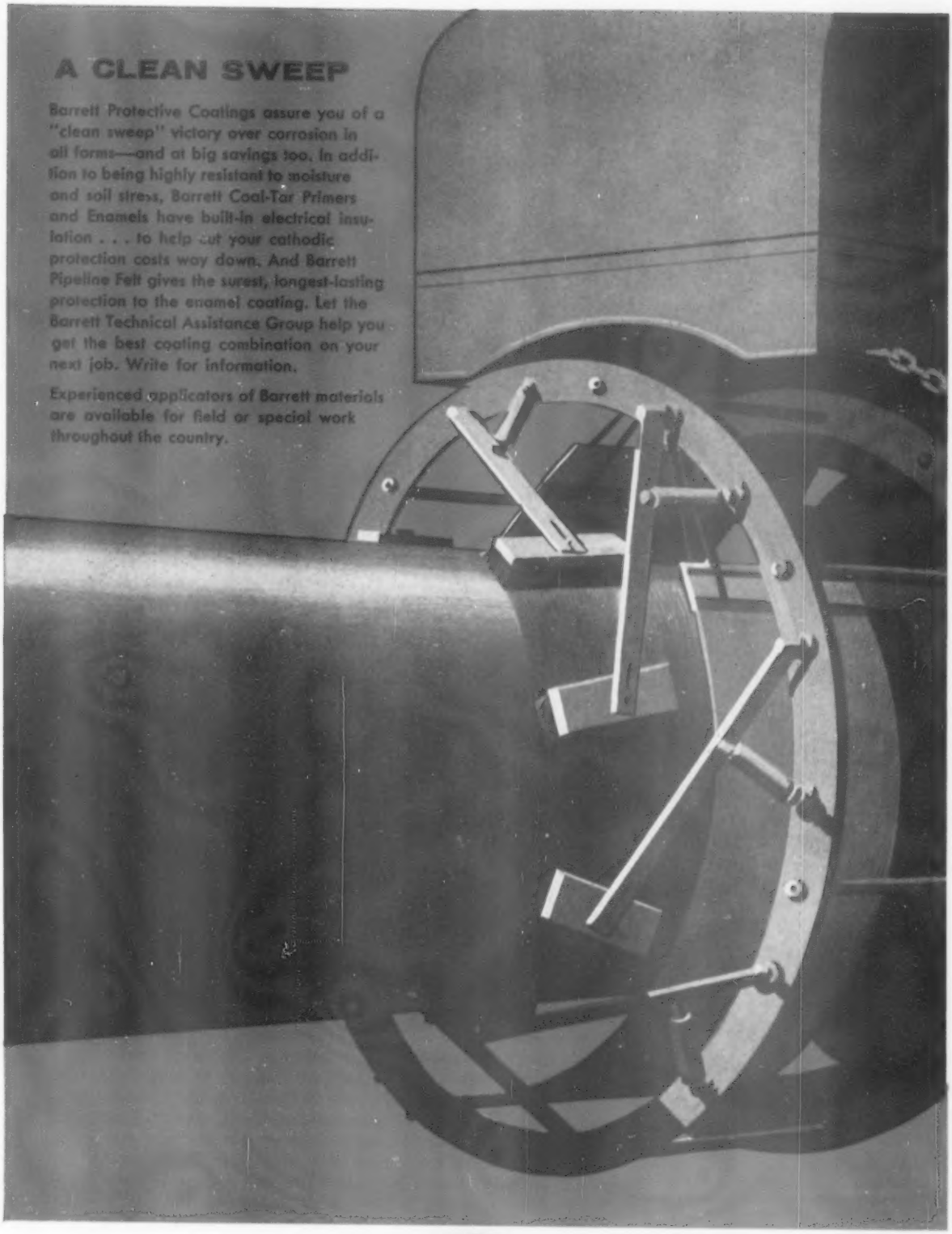
Pressure of explosive force merely opens out safety back

Instead of depending on blow-out plugs, entire back of Safecase Gauge is designed to yield to over-pressure. Photo at left shows actual result of firing cartridge within back of case. Safety-release back exhausted pressure. Front remained intact.

MARSH INSTRUMENT CO.
Sales affiliate of Jas/ P. Marsh Corp.
Dept. L, Skokie, Ill.
HOUSTON BRANCH PLANT:
1121 Rothwell St., Sect. 15, Houston, Texas
Marsh Instrument & Valve Co. (Canada) Ltd.,
8407 103rd St., Edmonton, Alberta, Canada

"THE STANDARD OF ACCURACY"

MARSH GAUGES


A CLEAN SWEEP
Barrett Protective Coatings assure you of a "clean sweep" victory over corrosion in all forms—and at big savings too. In addition to being highly resistant to moisture and soil stress, Barrett Coal-Tar Primers and Enamels have built-in electrical insulation . . . to help cut your cathodic protection costs way down. And Barrett Pipeline Felt gives the surest, longest-lasting protection to the enamel coating. Let the Barrett Technical Assistance Group help you get the best coating combination on your next job. Write for information.
Experienced applicators of Barrett materials are available for field or special work throughout the country.

Barrett®

PROTECTIVE COATINGS

BARRETT DIVISION, Allied Chemical & Dye Corporation, 40 Rector Street, New York 6, N.Y. In Canada: The Barrett Company, Ltd., 5551 St. Hubert Street, Montreal, Que.

OVER 100 YEARS OF EXPERIENCE

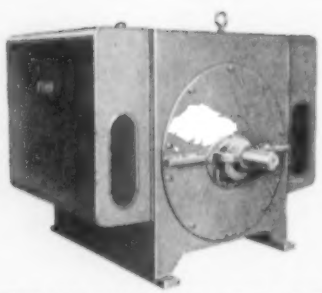
Allied Chemical

LOOK BEHIND THE "INSULATION CURTAIN" BEFORE YOU SELECT A LARGE MOTOR

Skilled hands weave an impenetrable wall around every Elliott coil

The slot section of this Elliott Class A stator coil is being hand-wrapped with a Mylar*-backed pliable, laminated mica sheet. The Mylar provides a thin, tough, flexible backing which allows a 30% increase in the amount of mica used. Mica combines known high dielectric strength with proven ability to withstand temperature and age. Through it all, the skilled hands of the Elliott craftsman guide it carefully and surely.

In coil insulation, the most modern materials are no better than their application. That is why coil insulation is a long painstaking process at Elliott. Extra precautions are taken at coil leads, joints and end sections. Vacuum-pressure impregnation plus *complete immersion* of each wound stator insures full penetration and an all-over sealing by a specially selected, time-proven insulating varnish. It's all part of an insulation process for 600 volt through 4800 volt coils first developed by Elliott in 1948 to withstand moisture, dirt, chemical fumes, etc. In all these years this insulation system has never suffered an operating failure. Get the facts on this sure "field-proven" insulation system. Ask your Elliott field engineer or write Elliott Company, Ridgway Division, Ridgway, Pa.



Elliott squirrel-cage induction motors lead the field in insulation. Since 1948, out of 1,400,000 hp of motors with this insulation system, (installed in 42 states and 14 foreign countries) **not one stator coil has failed due to insulation breakdown or deterioration.**

RG-9

* Dupont Trademark

ELLIOTT Company

Elliott large motor insulation is "field-proven"

A SET OF MATCHED IRONS

to improve Diesel and Gas Engine Performance

Like a golfer's set of matched clubs, each piston ring in a PEDRICK ENGINEERED SET is picked for its special ability to do its particular job more efficiently than any other ring. Consequently, PEDRICK ENGINEERED SETS are best able to meet the *individual* requirements of different engines. From top piston groove to bottom, PEDRICK RINGS deliver complete blow-by control, maximum lubrications with minimum oil waste, a more perfect seal for higher compression and longer life *plus* full power for every engine.

Whatever your requirements . . . engineered sets or single rings . . . you get more efficient performance when you specify PEDRICK PISTON RINGS. Engineering service is available to help you with special problems. Write, wire or phone: WILKENING MANUFACTURING CO., Philadelphia 42, SAratoga 9-3770

Pedrick PISTON RINGS

PEDRICK PRECISIONEERING KEEPS PEDRICK FIRST

another

first

from

WESTERN

research!

WESTERN Engineered WELL SERVICES

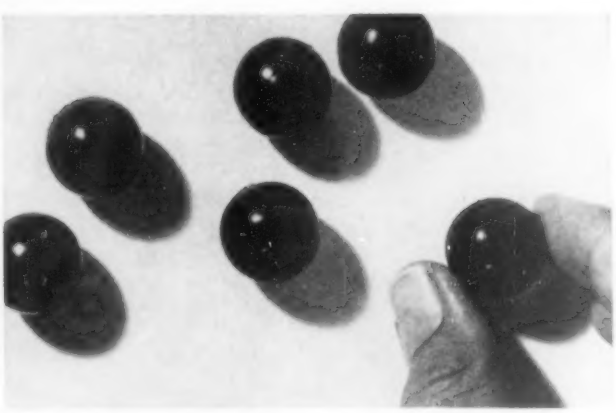
NEW PERFORATION BALL SEALERS

a controlled treatment method

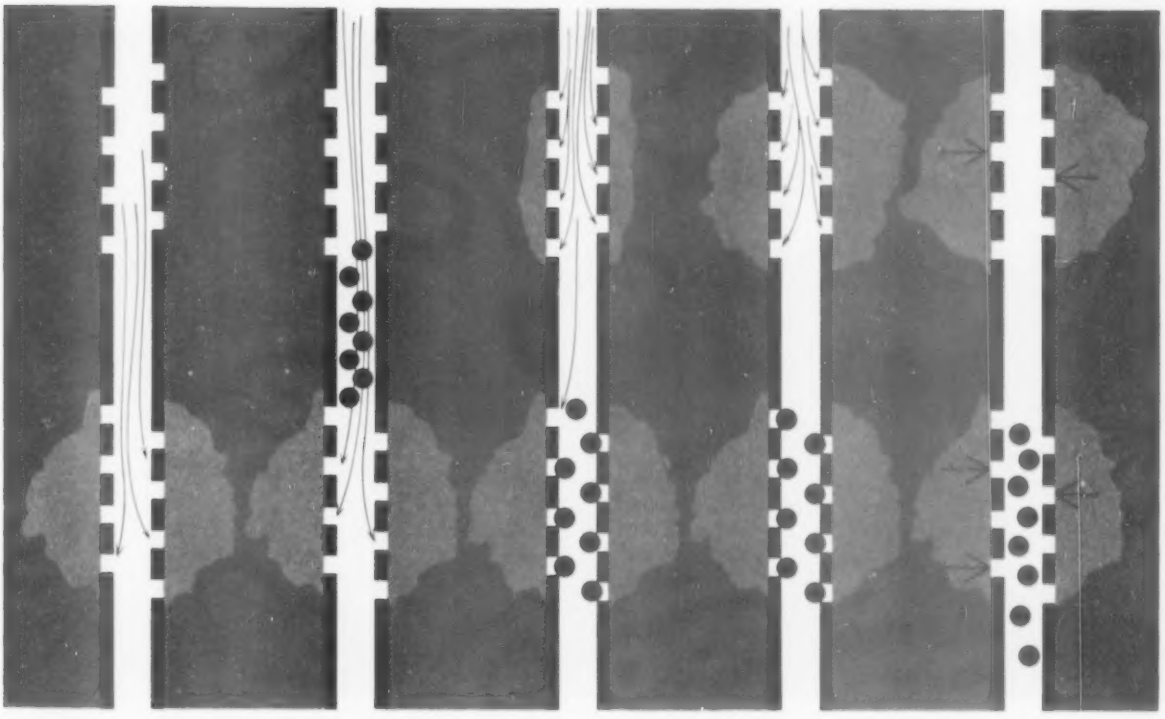
that is ➤effective

➤economical

➤practical



Texas: Odessa, Seagraves, Snyder,



TYPICAL APPLICATION OF PERFORATION BALL SEALERS

1 *Treating fluid entering most permeable zone through perforations.*

2 *Ball Sealers injected into line, follow flow of fluid down well.*

3 *Flow of fluid to permeable zone is blocked as balls seal perforations, and fluid begins to enter upper perforated zone.*

4 *Upper zone is completely treated while sealers remain in place on lower perforations.*

5 *Pressure is reversed and Ball Sealers drop to bottom of well. Both zones are completely treated.*

— Complete fracturing and acidizing treatments-on one set-up—are yours with Western's revolutionary *Perforation Ball Sealers.*

— Perforation Ball Sealers are the most effective, efficient, and economical means of securing fully controlled, selective treatments—replacing the need for chemical or mechanical blocking agents.

— Ball Sealers temporarily seal off the most permeable perforated sections to divert treating fluids into tighter sections of the formation and completely treat the entire pay zone. Your savings in time and expense are obvious—whether your well is old or new.

— For complete details on this great new treating aid, call your nearest Western station, or write Box 310, Midland, Texas. And get the most effective and economical control in fracturing and acidizing—Western's Perforation Ball Sealers.

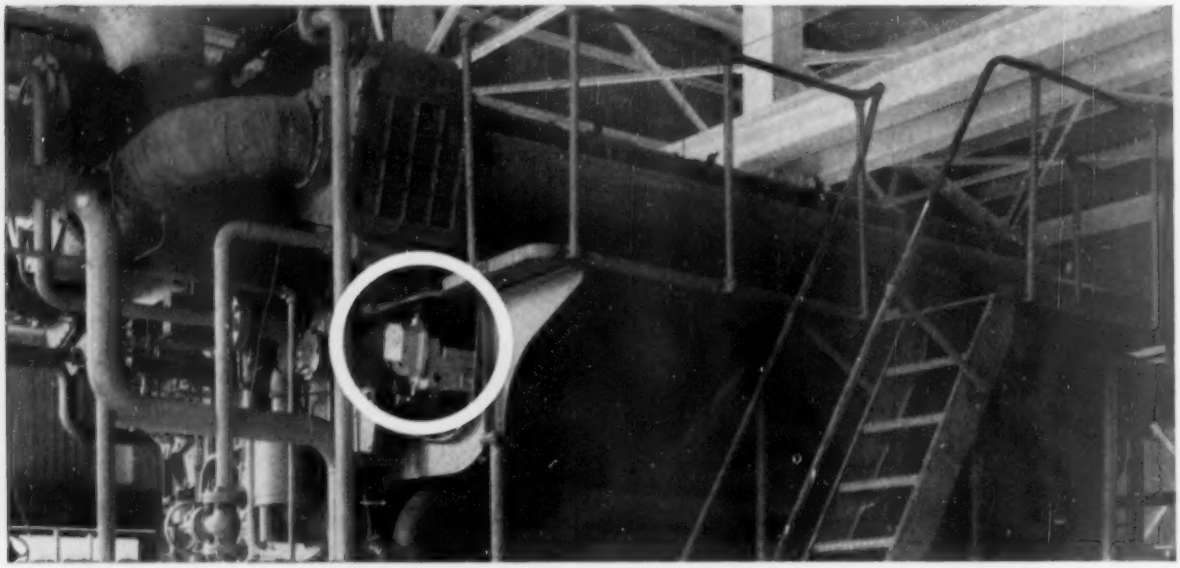
THE WESTERN COMPANY

general offices: Midland, Texas

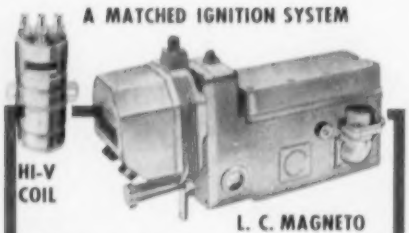
Lubbock, Borger, Rankin | *Oklahoma:* Lindsay, Healdton, Okla. City | *New Mexico:* Hobbs | *Kansas:* Ulysses, Liberal

BLUE SUNOCO

SUN OIL COMPANY



uses Cooper-Bessemer Engines with BENDIX MAGNETOS at their Marcus Hook Refinery!



1. Long service life
2. Simplified maintenance
3. Longer spark plug life
4. No unscheduled ignition shutdowns
5. Positive spark timing
6. High voltage output
7. Matched ignition system
8. Single or dual ignition
9. Flame proof
10. Low maintenance costs
11. For engines of 6 through 16 cylinders

Pictured above is a section of the power equipment used by the Sun Oil Company in an ammonia plant at their huge Marcus Hook Refinery.

Typical of Sun's utilization of the most modern equipment in their refining process is this Cooper-Bessemer Model LSV12 engine equipped with Bendix* L. C. Magneto and Hi-V Coil.

Because the Bendix L. C. is a completely new type of magneto, it incorporates the latest developments in engineering, design and production techniques. The result is a matched ignition system—L. C. Magneto plus Bendix Hi-V transformer coils—that delivers more than ample voltage with greatly reduced maintenance costs.

That's why whenever top performance is a must, you'll find more and more important operators making the new Bendix L. C. Magneto their choice.

*TRADE MARK

SCINTILLA DIVISION OF BENDIX AVIATION CORPORATION, SIDNEY, NEW YORK

Export Sales and Service: Bendix International Division, 205 East 42nd St., New York 17, N.Y.
Canadian Affiliate: Aviation Electric Ltd., 200 Laurentien Blvd., St. Laurent, Montreal 9, Quebec.

FACTORY BRANCH OFFICES: 117 E. Providencia Avenue, Burbank, California · 512 West Avenue, Jenkintown, Pennsylvania · Paterson Building, 18038 Mack Avenue, Detroit 24, Michigan · 5906 North Port Washington Road, Milwaukee 17, Wisconsin · Hulman Building, 120 West Second Street, Dayton 2, Ohio · 8401 Cedar Springs Road, Dallas 19, Texas · Boeing Field, Seattle 8, Washington · 1701 "K" Street, N. W., Washington 6, D. C.

Bendix SCINTILLA DIVISION

Bendix AVIATION CORPORATION

NATIONAL STORES
get a new look to serve you better!

Have you recently noticed any "face-lift" jobs on older National Supply Stores in your area? If you haven't, you may see some soon. Each will be part of a long-range store modernization program we've put into effect to serve you better.

The old wooden, space-wasting porches, remnants of another era, are going. Instead you'll find new concrete-based loading docks, with high and wide openings for easier, faster stock handling. Heavy equipment yards are losing that "stockpile" look as machinery is evenly spaced and arranged for your close inspection. There are bright new National signs, too—just so our newer friends won't miss our locations. Over-all, store exteriors are looking very modern and efficient. But that's only half of the new look story.

National Supply Store *interiors* are getting the treatment, too. In glare-proof lighting, you'll see long, modern counters—some with "picture window" fronts. There are new shelves and bins. Colorful displays. Handy product literature racks, loaded with helpful information. In a modernized or new National Supply Store, you can quickly see and personally select the quality equipment, parts and accessories you need.

This "operation face-lift" means more convenient and time-saving shopping for you. In effect, it means we can serve you better and faster. Why not try this service soon?

THE
NATIONAL SUPPLY
COMPANY

You don't have to pamper these

Pumping units, especially, have to be "pamper-proof." They have to be simple, compact and strong—you want them to operate constantly for long periods with very little attention. Check these features of National "Type E" Pumpers, and you'll see why they easily meet these requirements:

Easy-to-install, extra strong main base. Box and sub-base design of the "E" units provides maximum strength, rigidity and counterweight clearance for quick and simple floor level installation.

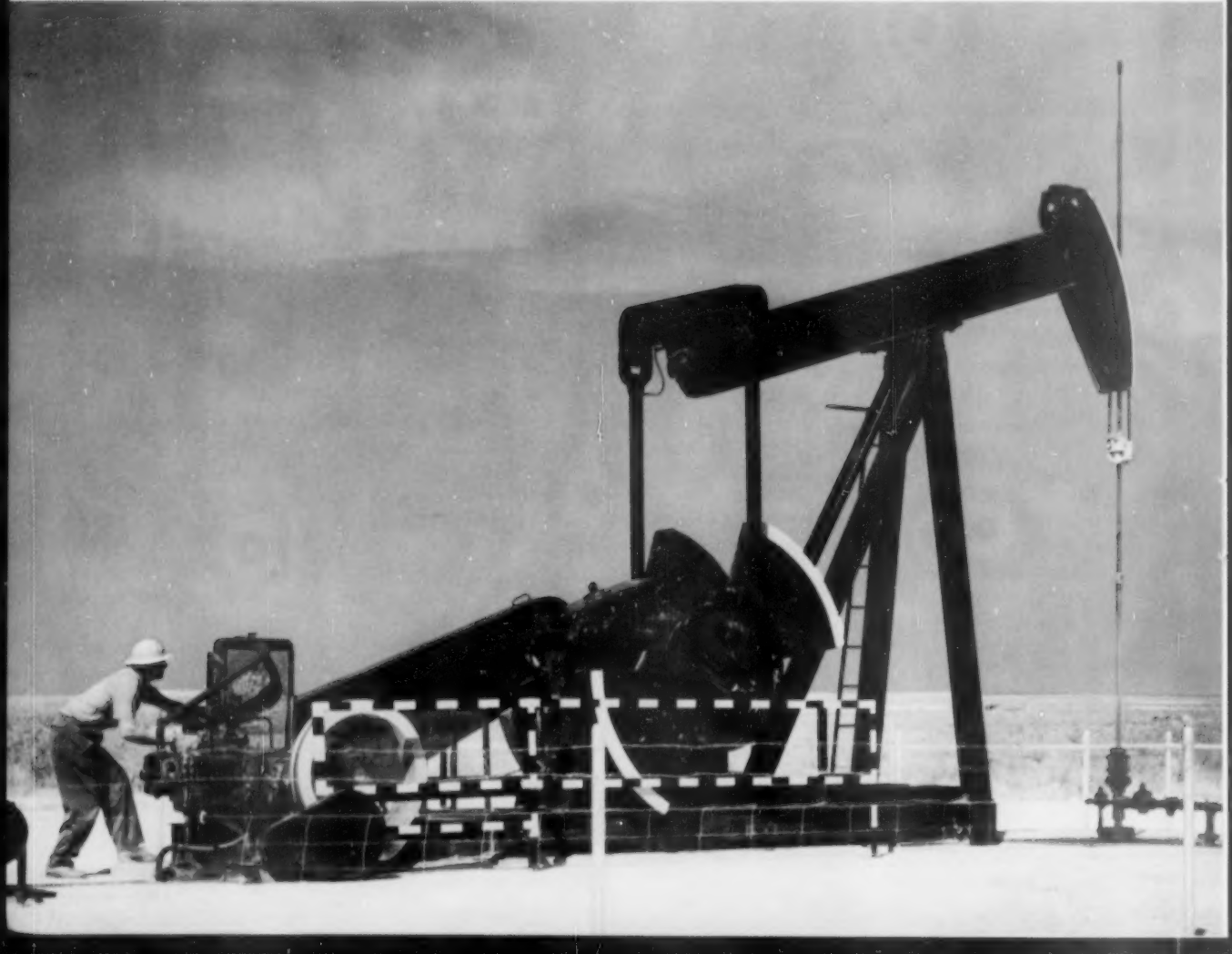
Rugged gear reducer for extra stamina and longer life. National "Type E" Pumping Units have exceptionally hard alloy steel gears and pinions designed for long wearing life. Gear train mounting and main bearings offer lower shaft loading and deflection . . . easily handles shock loads from load reversals.

Exceptionally stable, well balanced samson post. Legs are rigidly cross-braced, designed to distribute beam load over entire foundation area, and to give better balance for transporting.

Pitman assembly features easy maintenance, fast assembly. The simple, clean design of Pitman assembly components insures positive alignment and proper fitting. Over-all construction of the assembly makes field servicing simple and easy.

Rugged walking beam and beam hanger for extra years of service. Heavy-duty walking beam is designed for minimum critical stress in National's "Type E" Pumping Units. The beam hanger design insures correct alignment to the polished rod throughout the stroke range, and is built for easy field servicing of its component parts.

Get the complete facts on National "Type E" Pumpers today. For the full story on the high performance and low operating costs they offer, see the National Supply Store men or representatives in your area soon. New bulletins describing these quality pumping units are available.



NATIONAL "TYPE E" PUMPERS!

It pays to get
the pumper that's just right
for the job from

NATIONAL'S
COMPLETE LINE
OF TYPES AND SIZES

Beam Counterbalanced Types	API Walking Beam Rating, Lb.
D-3	3,200
D-4	4,100
D-5	4,790
D-7	6,500
E-9	8,900
E-11	11,000

Crank Counterbalanced Types	API Walking Beam Rating, Lb.
E-9	8,900
E-11	11,000
E-13	12,750
E-15	15,000
E-21	21,000
E-24	24,000
D-29	29,900
D-32	32,400

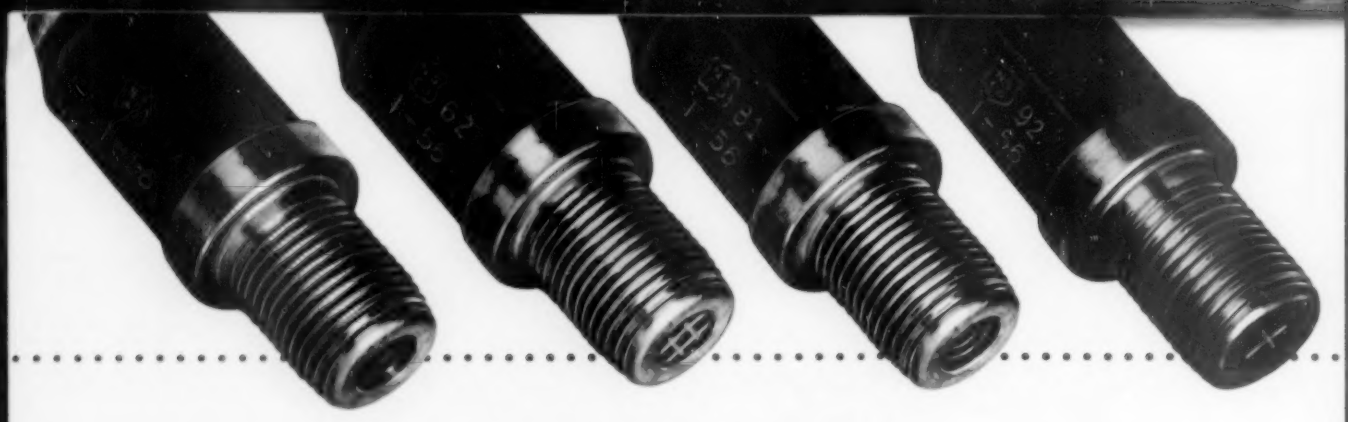
The complete line of National Pumping Units offers a model to economically suit every pumping job. In the range of API rated beam loads from 3,200 to 32,400 lbs., there are 22 standard combinations to meet your requirements. Get complete details at the National Supply Store in your area.

THE
NATIONAL SUPPLY
COMPANY

MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.
DIVISION OFFICES: Denver; Fort Worth; Houston; Toledo; Tulsa; Torrance
CANADA: The National Supply Company, Ltd., 200 F. W. Clark Building, 709 Eighth Avenue, West, Calgary, Alberta
EXPORT: 600 Fifth Avenue, New York 20, N. Y., U.S.A.; City Wall House, Chiswell Street, London E. C. 1

NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE • SPANG ELECTRICAL CONDUIT

More National equipment for profitable production . . . on the next page



Grade 40—for little or no corrosion

Grade 62—for medium corrosion-medium sulphide

Grade 81—for bad corrosion but little sulphide

Grade 92—for severe sulphide corrosion

You get trouble-free service at any depth WITH NATIONAL SUCKER RODS!

Whatever the pumping conditions, you get low-cost sucker rod service when you select the National string that's right for the job. National Sucker Rods are:

Quality-controlled to give you the ultimate in uniformity, dependability and economy

Engineered for maximum resistance to shock, corrosion, fatigue and impulse loads

Precision-manufactured of top-grade steel on specially-developed machines

They reach you in factory condition, too, whether you order from stock at a National Supply Store or directly from the mill. National's careful methods for stacking, handling, shipping and field storage have been proved by hundreds of shipments to all parts of the world.

In a new bulletin covering National Sucker Rods, you can get complete information on the grades shown here. Ask the National representative in your area for a copy soon.

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MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.
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NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE • SPANG ELECTRICAL CONDUIT

You get sound performance, too, from . . .

NATIONAL Wellhead Equipment

Interchangeable units provide many combinations to meet your specific needs in size, capacity and type. Ease of assembly and pre-tested safety are two major features of this equipment.

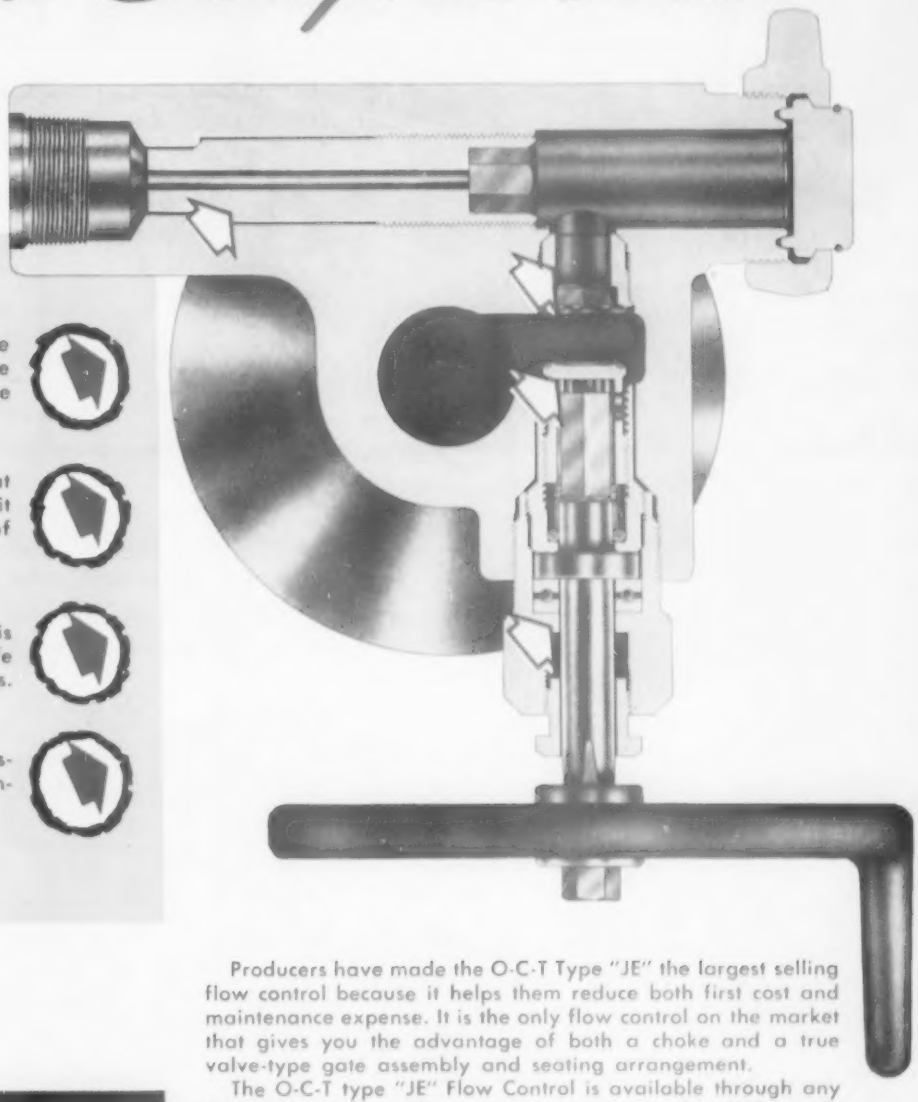
NATIONAL Ideal Plunger Lift®

This unit uses formation pressure for economically producing wells where reservoir conditions are suitable. For these certain types of wells, it can be the best production method.

NATIONAL Triplex Pumps

These pumps provide maximum volume and injection pressures for today's waterflood projects. Available in several hp ratings for both corrosive and non-corrosive service, they are especially suited as power-oil sources for subsurface hydraulic pumping, oil gathering and salt water disposal services.

Here's why the O·C·T "JE" is the *Largest Selling Flow Control*



Body can accommodate any size positive choke to 1" or adjustable choke up to ¾" opening.

Hard faced 1" valve seat is replaceable to permit complete renewal of valve in five minutes.

True valve-type gate is hard-faced for long life under severe conditions.

Ball thrust bearing assures easy operation under highest pressures.

Producers have made the O-C-T Type "JE" the largest selling flow control because it helps them reduce both first cost and maintenance expense. It is the only flow control on the market that gives you the advantage of both a choke and a true valve-type gate assembly and seating arrangement.

The O-C-T type "JE" Flow Control is available through any Christmas tree manufacturer or through more than 700 supply store locations.

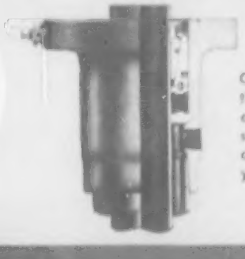
O·C·T

OIL CENTER TOOL CO.

P. O. Box 3091, Houston, Texas

Export Representatives: Sterling Areas — Le Grand, Sutcliff & Gell, Ltd., Rochester, Kent, England. South America—East West Oiltools, C. A., Del Lago Hotel, Maracaibo, Venezuela. Address Export Inquiries For All Other Countries to P. O. Box 3091, Houston, Texas.

No casing string too long . . .



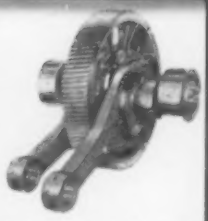
The O-C-T C-19 Casing head can support the longest strings with complete safety. It is the safest, most economical deep well casing head you can buy.

6 big reasons

WHELAND HP-18000 Heavy Duty Power Slush Pumps give extra performance!

Crank

One-piece steel casting heat treated. Compact eccentrics integral with crank give increased throw.

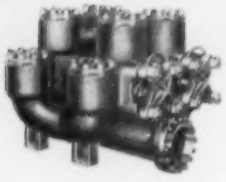


Crank Assembly

Strong and compact. Carburized helical main gear. One-piece steel connecting rods. Roller bearings throughout.

Wheland's Improved (Patented) Cast Steel Pot Covers

Feature metal-to-metal contact and independent gasket adjustment . . . saves time and gaskets.

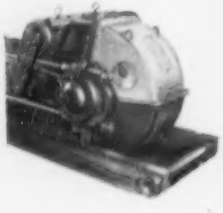


Fluid End

Simplified 1-piece steel casting with low-slung suction pot and short, streamlined fluid passages.

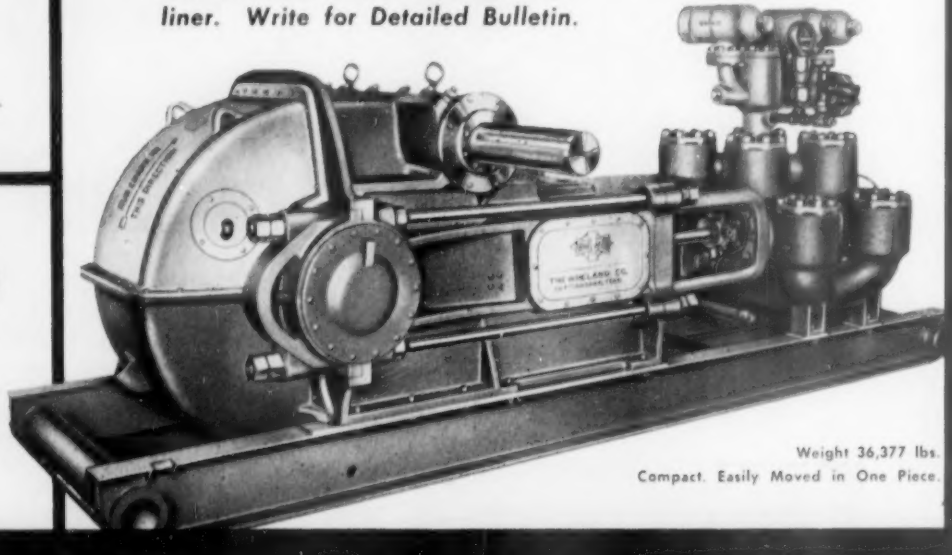
Patented Liner Retainer

and shoulder in fluid end holds liner with metal-to-metal contacts on both ends. Independent gasket adjustment from the outside saves time and gaskets.

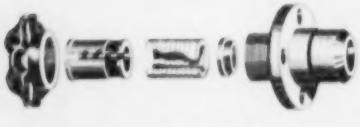


Fool-proof, trouble-free splash lubrication system. Reversible pinion shaft.

Wheland HP-18000 Duplex Power Slush Pump—7¾" x 18" 750 HP Nominal Input at 60 RPM—1322 lbs. mud pressure with 7¾" liner, 2700 lbs. with 5½" liner. Write for Detailed Bulletin.



Weight 36,377 lbs.
Compact. Easily Moved in One Piece.



Oil Circulating Screw Type Stuffing Box

Screw type gland maintains perfect alignment of packing with fluid rod. Easy to adjust and assures longer life for packing and water piston rod.

WHELAND

ROTARY DRILLING MACHINERY

THE WHELAND COMPANY

CHATTANOOGA, TENNESSEE, U.S.A.

DRAW WORKS • SLUSH PUMPS • ROTARIES

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BUTLER buildings GO EVERYWHERE, DO EVERYTHING

for the oil industry

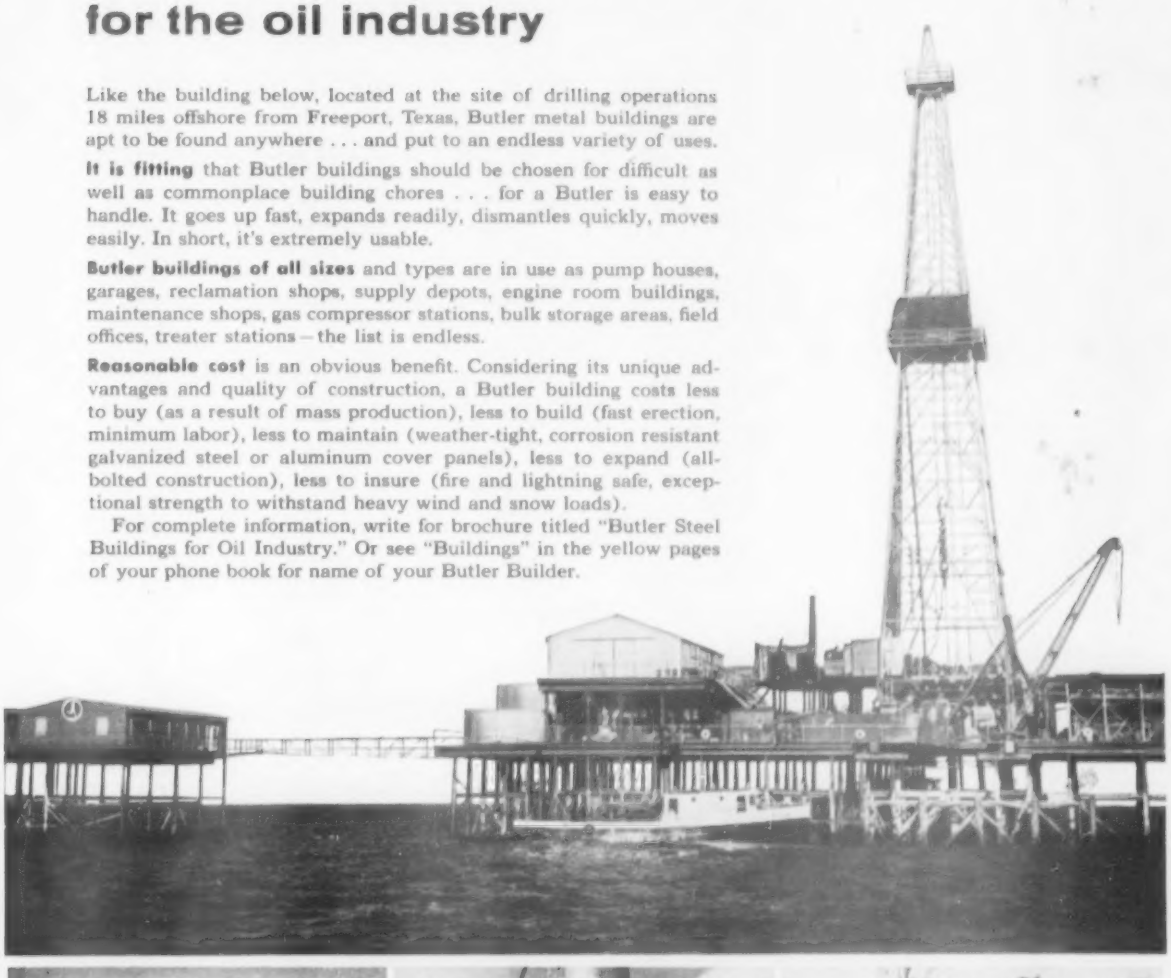
Like the building below, located at the site of drilling operations 18 miles offshore from Freeport, Texas, Butler metal buildings are apt to be found anywhere . . . and put to an endless variety of uses.

It is fitting that Butler buildings should be chosen for difficult as well as commonplace building chores . . . for a Butler is easy to handle. It goes up fast, expands readily, dismantles quickly, moves easily. In short, it's extremely usable.

Butler buildings of all sizes and types are in use as pump houses, garages, reclamation shops, supply depots, engine room buildings, maintenance shops, gas compressor stations, bulk storage areas, field offices, treater stations—the list is endless.

Reasonable cost is an obvious benefit. Considering its unique advantages and quality of construction, a Butler building costs less to buy (as a result of mass production), less to build (fast erection, minimum labor), less to maintain (weather-tight, corrosion resistant galvanized steel or aluminum cover panels), less to expand (all-bolted construction), less to insure (fire and lightning safe, exceptional strength to withstand heavy wind and snow loads).

For complete information, write for brochure titled "Butler Steel Buildings for Oil Industry." Or see "Buildings" in the yellow pages of your phone book for name of your Butler Builder.



Butler rigid frame reclamation shop in Tulsa, Okla.

Butler Panl-Frame treater house in Virden, Manitoba

Butler rigid frame gas compressor station in Darnsythe, Pa.

BUTLER STEEL PRODUCTS

BUTLER MANUFACTURING COMPANY

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YOUR ACE IN THE HOLE
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HOMCO's Directional Drilling Engineers are experienced in every phase of directional drilling. Carefully selected men are given Homco's organized training program*—extensive organizational and technical training in the classroom, then complete their training in the field under the supervision of an experienced directional drilling engineer. These highly trained men, combined with the latest methods, tools and equipment are your ace in the hole for Directional Drilling and Oil Well Surveying operations.

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THE WORLD'S LARGEST INDEPENDENT OILFIELD SUPPLY AND SERVICE ORGANIZATION

They Say—

Market Collapse Possible

"If we are to avoid a market collapse in the near future, oil industry leaders need quickly to reexamine the volume of crude runs through their refineries. Under present operating rates, gasoline stocks have been built up to excessive levels on the very threshold of the seasonal drop in demand.

"Nationally, crude runs to refineries for the past 5 weeks have averaged 7,983,000 bbl. per day as compared with 7,572,000 during the same period of 1955, up 411,000 bbl. per day. This increase is at least 200,000 bbl. per day over the runs needed to meet total requirements.

"With the season of peak gasoline demand ending, and with the seasonal peak for fuel oils fast approaching, this already bad situation could develop into a disastrous one if crude runs continue at this reckless pace. Reduced runs and product yield adjustments are clearly indicated.

"No one oil company is responsible for the industry situation—every company shares the responsibility . . . This increasingly serious problem calls for business leadership, not in concert but through individual, independent appraisal and through common-sense, sound-business action. Such appraisal and action would be in the interests of each company, of the oil industry, and of the national economy."

Frank O. Prior, president of Standard Oil Co. (Indiana), in a statement to the trade press.

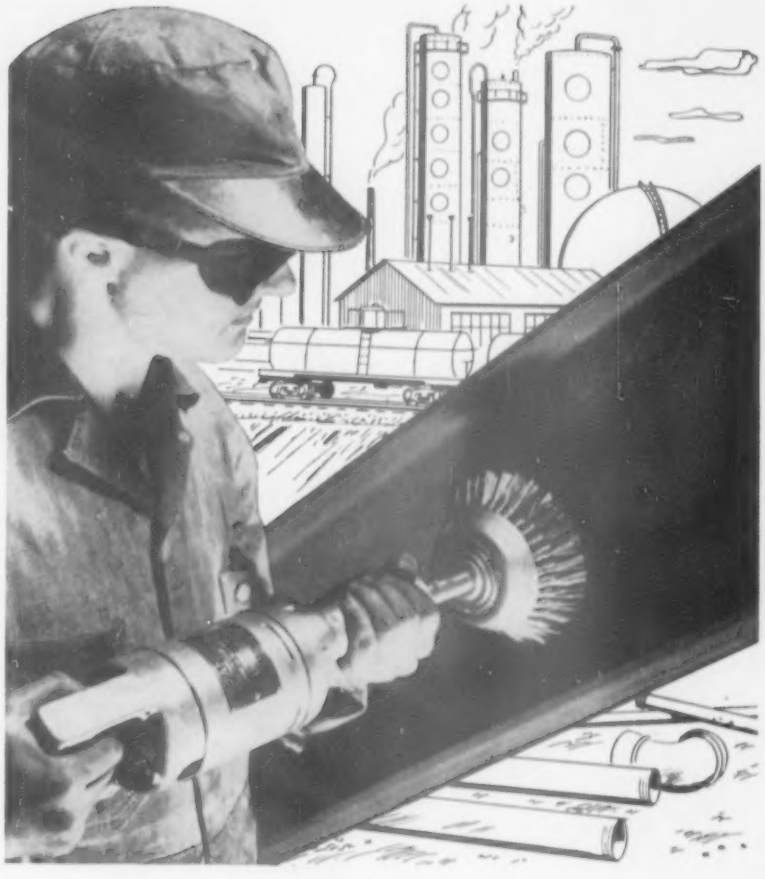
South Dakota Needs Fair Trial

Dear Sir:

It wasn't long ago that wherever one happened to be, the Williston basin would be the main topic of conversation. South Dakota, a good portion of it, was the southern member of this basin, and for a time enjoyed the limelight. Shell Oil Co. brought in the first producer, and then followed the rash of leasing and drilling. South Dakota was virtually afire.

Then it seemed to suddenly collapse and die aborning like the old time Texas oil boom. Both majors and independents developed first class cases of cold feet. After sporadic and shallow tests, both camps packed their equipment and departed for easier development work. Even the vaunted wildcatter had packed bag and baggage.

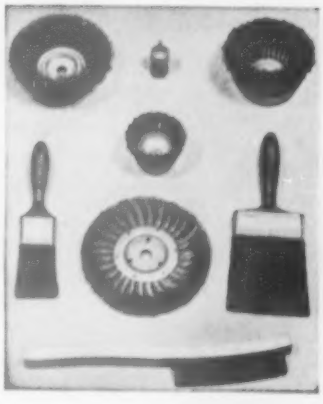
Exploratory drilling today, I am firm-



Big jobs are easy jobs

HIGH speed Osborn power brushes take all the effort out of cleaning rust, scale and old paint from large metal surfaces. Rugged, special analysis wire quickly bites through the most stubborn rust and other surface crusts . . . keeps brushes in service longer.

For information on Osborn's complete line of top-quality industrial brushes, write for Catalog 210-B. *The Osborn Manufacturing Company, Dept. N-12, 5401 Hamilton Avenue, Cleveland 14, Ohio.*



Osborn has a brush to meet every industrial need—power, paint or maintenance . . . and you get quality automatically when you specify "Osborn".

Osborn Brushes

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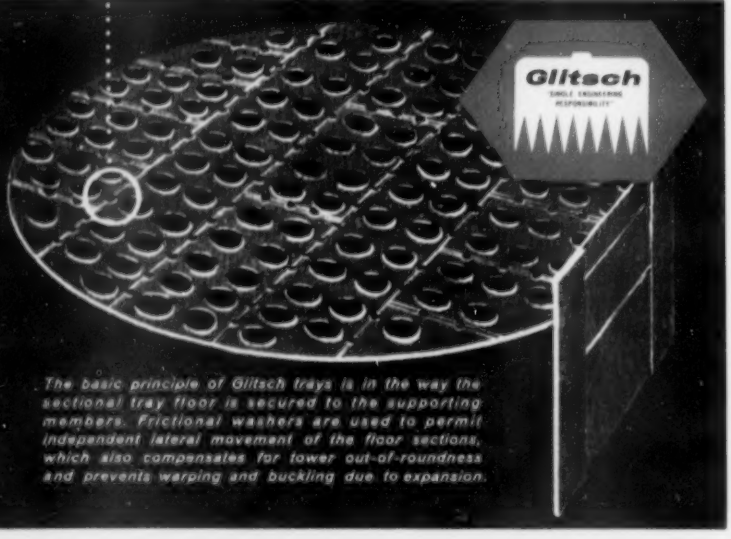
BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

Glitsch
"Truss-Type"®
Bubble Trays
TIME-SAVING — COST-SAVING
On Installation and Take-Down

Lightweight Glitsch "Truss-Type"® Trays are comparable in first-costs to heavy plate trays, but when continued economy is considered these facts are significant: Glitsch trays allow use of lightweight alloys, yet provide maximum strength and rigidity for tray sections. Each tray can be installed and removed in sections through the tower manways. "Truss-Type"® Trays are simple in design and can be adapted to any process requirement, any flow type, vessel size, and layout, without sacrificing any features of installation or removability. In addition, when critical corrosion-resistant alloys are required throughout a new unit, Glitsch trays allow a wider distribution of the available materials.

Regardless of your requirements, "Truss-Type"® Trays will save you time and money in the long run. For full details, call your Glitsch representative and ask for a copy of our Catalog No. 150, or write to us at P. O. Box 6227, Dallas. There is no obligation, of course.



The basic principle of Glitsch trays is in the way the sectional tray floor is secured to the supporting members. Frictional washers are used to permit independent lateral movement of the floor sections, which also compensates for tower out-of-roundness and prevents warping and buckling due to expansion.

ly convinced, is a hit and run affair. In South Dakota, for example, a firm would make a location, drill a few hundred feet, abandon the well and leave the county. Most of the counties in South Dakota have been so honored. An area cannot be condemned for a few scattered, abandoned tests.

With methodical exploratory drilling in this mineral rich state of South Dakota we can obtain petroleum reserves to equal those of our Canadian neighbors. South Dakota must not be bypassed in the search for oil. It offers many opportunities. The fundamental rocks are shallow and the geological column is excellent. Favorable structures are known to exist, and others will be found as subsurface information is built up by the drilling of wells to the granite. Geological conditions are all favorable to oil accumulation. Concentrated test drilling will put South Dakota in the limelight again. South Dakota needs only a Citronelle.

Leon Akopian, consultant
Van Nuys, Calif.

Hooper Dadoscope an Old Joke

Dear Sir:

I was very much interested in your article on the Hooper dadoscope on page 45 of the August 6 issue of the Big Yellow Book.

This device was actually a development of investigations conducted during World War II. . . .

It created quite a furor in scientific circles at that time, but apparently commercial application was delayed until now.

F. T. Klopsch
Havertown, Pa.

Natural-Gas Group Needed

Dear Sir:

Gas conservation, L.P.G., petrochemical, and the use of gas for domestic purposes are growing rapidly in Venezuela at this time. A few of us who work for Creole and other companies . . . are of the opinion that much good could be derived from a natural-gas organization chapter. Many of us, in the past, have been members of N.G.A.A. and C.N.G.A. Since these organizations are firmly established, it is our desire to become affiliated and to form a V.N.G.A.

Would you be so kind as to send me the names and addresses of the secretaries of these organizations and any other information that you may have at hand that would be of value to us.

C. H. Cass
Mechanical maintenance foreman
Creole Petroleum Corp.
Tia Juana, Venezuela.

(Editor's note: We agree that Venezuelan operations are expanding mark-

ON THE JOB

where quality pays off...

The man on the job buys a valve for a specific use because he knows from experience that the valve will get the job done. He knows the valve offers the best design, construction and materials to meet known operating conditions. He buys a valve with all the qualities required by a specific use. For many years thousands of men in the field have selected ORBIT valves because they have the kind of **quality** that pays off on the job!

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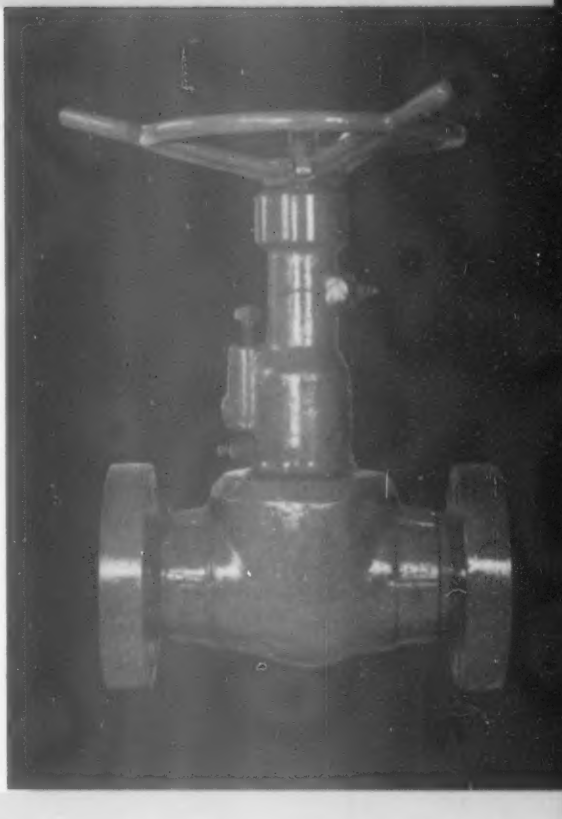

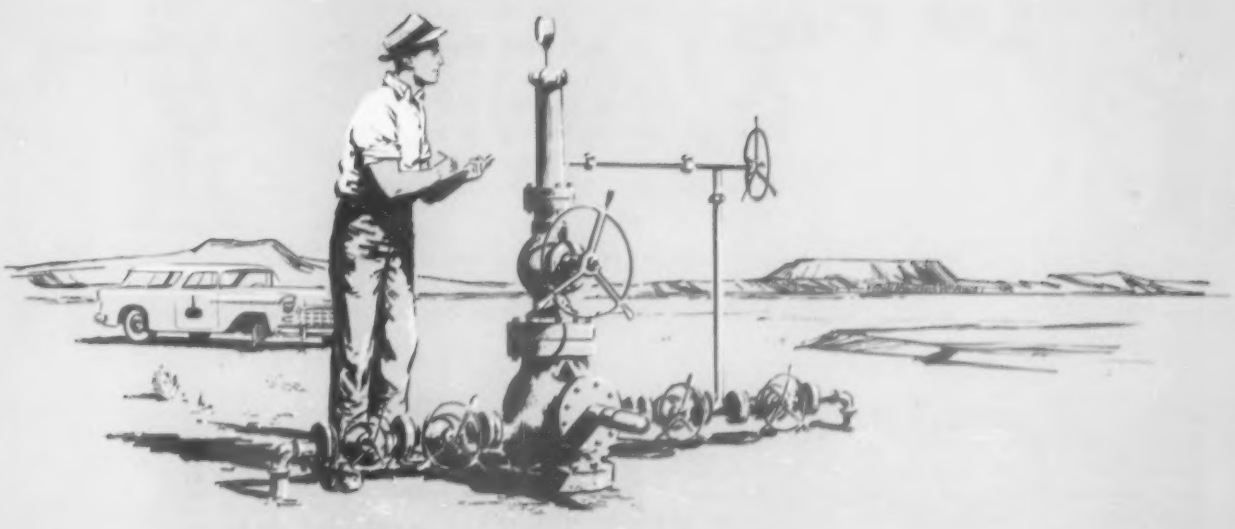

LP Gas • • • and Beacon Petroleum Company

It wasn't too long ago that gas was flared at the well site. Today this gas has become an important source of revenue for oil producers. With an experienced and aggressive staff, Beacon Petroleum offers producers a service they find impossible to duplicate.

If you have any petroleum products to sell, contact Beacon . . . or if you want to buy petroleum products contact Beacon . . . we have the facilities and know-how to fulfill your every need.

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MARKETERS OF NATURAL GASOLINE, BUTANE-PROPANE, MOTOR FUEL, FUEL OILS

edly in the fields of natural gas, natural gasoline, L.P.G., and repressuring—as well as in crude-oil production itself. Much good in the way of educational and operational advantages could be obtained from having a Venezuelan natural gas-natural gasoline technical study organization. The Natural Gasoline Association of America and the California Natural Gasoline Association, for many years have greatly assisted in the technology and operation of the industry.

Florida Pipeline Debated

"Natural gas should be provided to Florida as a matter of public policy because the state is now too heavily dependent for fuel and electric power on a single source, namely, petroleum products brought by water.

"It will confer immediate benefits in cost saving and convenience on household and commercial consumers, tourists, and industry. In the longer run the benefits will be even greater and will include an important stimulus to industrial development, which will help balance the state's economy."

P. M. Schuchart, director of public utilities department of the Florida Railroad and Public Utilities Commission, in testimony at the Federal Power Commission hearing on a gas pipeline to Florida proposed by Houston Texas Gas & Oil Corp.

CALENDAR OF EVENTS

SEPTEMBER

11-13 Pacific Coast Gas Association, annual meeting, Hotel del Coronado, Coronado, Calif.

12-14 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

16-18 Pennsylvania Petroleum Association, annual meeting, Pocono Manor Inn, Pocono Manor, Pa.

16-18 New Mexico Petroleum Industries Committee, annual convention, Hilton Hotel, Albuquerque.

16-21 American Chemical Society, 130th annual meeting, Atlantic City, N. J.

19-21 Southeastern Gas Association, Hotel Sir Walter, Raleigh, N. C.

16-21 American Society for Testing Materials, second Pacific area national meeting, Statler Hotel, Los Angeles.

17-21 Instrument Society of America, eleventh annual international instrument-automation conference and exhibit, New Coliseum, New York.

20-21 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Hotel Henning, Casper, Wyo.

THIS IS THE STORY of three men and a VALVE. Joe, a chemical engineer, needed valves that could handle tough corrosives. Bill, a refining engineer was looking for valves that gave a positive shut-off. Tom, working for a large industrial firm, needed valves that sealed both upstream and downstream. All three solved their problems by specifying Hamer Visible Wedge Valves. These remarkable valves combine the double sealing action of precision metal-to-metal fit augmented by dependable seal rings. The wedges are trimmed with nickel, while seats are trimmed with stainless steel to withstand the roughest corrosive conditions. The full-view wedges are handwheel operated --can't blow out or drop on a toe. The wedges pivot so no lifting is necessary.

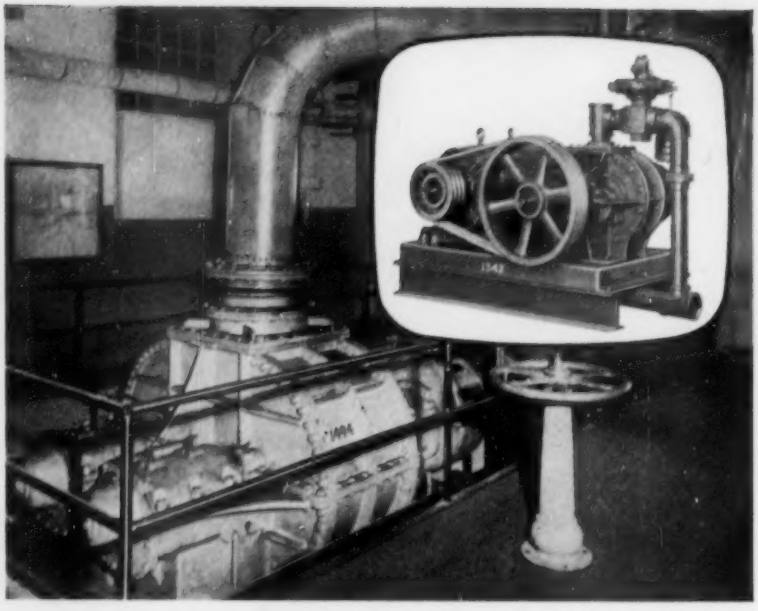
So if your plans require long service, sure-seal shut-off valves, by all means specify

HAMER VISIBLE WEDGE VALVES.

P.S. For descriptive literature, write:

Hamer **VALVES, INC.**

2919 Gardenia Ave., Long Beach 6, California
Representatives Throughout the World.



ALL SIZES OF R-C GAS PUMPS INCLUDE *plur-ability* VALUES

Positive control of volume and pressure, with the simple rotary impeller principle, stands out as one of the most valuable advantages of Roots-Connersville Gas Pumps. They deliver this prime essential, whether at a trickle of 5 cfm or an outpouring of 50,000 cfm.

This same simplicity of design, with sturdy construction, means little wear-out, down-time or maintenance. These *plur-ability* values mean that your R-C Pumps will probably outlive the equipment they serve.

With 76 sizes and capacities, R-C Rotary Positive units can be closely matched to your work. Or, if your plans call for Centrifugal Pumps or Exhausters, Roots-Connersville is the only builder offering you an unbiased *dual choice.*

Write for latest details and specifications in Bulletin 31-B-17 for small sizes and Bulletin 32-33-B-13 for larger units.

Ask about *plur-ability* in all R-C equipment

Centrifugal and Rotary Positive Blowers, Gas Pumps and Exhausters
•
Positive Displacement Vacuum Pumps and Meters

Inert Gas Generators
•
Spiraxial® Compressors
•
Detailed bulletins available on all R-C equipment.

ROOTS-CONNERSVILLE BLOWER

A DIVISION OF DRESSER INDUSTRIES, INC.

956 Oak Avenue, Connersville, Indiana. In Canada, 629 Adelaide St. W., Toronto, Ont.

20-21 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual membership meeting, Roosevelt Hotel, New Orleans.

20-21 National Association of Corrosion Engineers, sixth annual short course, Centenary College, Shreveport, La.

21 Southern Gas Association, conference of gas measurement superintendents, Tutwiler Hotel, Birmingham, Ala.

20-22 Oklahoma City Geological Society, field conference, Guymon, Okla.

24-26 American Society of Mechanical Engineers, petroleum mechanical engineering conference, annual meeting, Statler-Hilton Hotel, Dallas.

26-28 Rocky Mountain Mineral conference, American Institute of Mining, Metallurgical & Petroleum Engineers, Newhouse Hotel, Salt Lake City.

28 Natural Gasoline Association of America, Oklahoma regional meeting, Skirvin Hotel, Oklahoma City.

OCTOBER

1-5 American Institute of Electrical Engineers, fall general meeting, Morrison Hotel, Chicago.

2-3 Texas Mid-Continent Oil and Gas Association, thirty-seventh annual meeting, Rice Hotel, Houston.

3-5 Standards Engineers Society, fifth annual meeting, Hotel Willard, Washington.

7-9 American Association of Oil Well Drilling Contractors, annual meeting, Texas Hotel, Fort Worth.

8-10 American Society of Mechanical Engineers, American Society of Lubricating Engineers, lubrication conference, Chalfonte-Haddon Hall, Atlantic City, N. J.

9-10 Southwest Kansas Petroleum Industry and University of Kansas, fourth annual two-day gas measurement institute, Liberal, Kan.

10-12 International Geological Symposium of the Williston Basin, Bismarck, N. D.

11-12 California Natural Gasoline Association, fall meeting, Sheraton Huntington Hotel, Pasadena, Calif.

14-17 American Institute of Mining, Metallurgical & Petroleum Engineers, Petroleum Branch, fall meeting, Biltmore Hotel, Los Angeles.

14-20 OIL PROGRESS WEEK.

15-17 American Gas Association, annual meeting, Atlantic City, N. J.

18-19 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.

18-21 Permian Basin Oil Show, Odessa, Tex.

22-24 National Lubricating Grease Institute, annual meeting, Edgewater Beach Hotel, Chicago.

22-24 Rocky Mountain Oil and Gas Association, annual convention, Cosmopolitan Hotel, Denver.

23-26 National Association of Corrosion Engineers, south central region, San Antonio.

24-26 Tracerlab Symposium on Applications of Radioactivity, Hotel Statler, Boston.

25-26 American Society of Mechanical Engineers, American Institute of Mining, Metallurgical & Petroleum Engineers, nineteenth annual meeting, Sheraton Park Hotel, Washington.

26 Natural Gasoline Association of America, southern regional meeting,

Get Rugged Clear-Span Design • Luxury Look of Stran-Satin with

New Stran-Steel Rigid Frame Building Line

New Stran-Steel Rigid Frame buildings have the look of quality never before achieved in an all-steel building. However, quality doesn't stop with appearance . . . it is built *right* into every part of the structure.

Start with the smart *Stran-Satin* exterior finish. *Stran-Satin* metal wall, exclusive with Stran-Steel, provides a strong, durable panel with the weather resistance of zinc-coated steel and the smooth spangle-free look of expensive materials. Peaks, gables and eaves are completely enclosed with smart fascia flashing.

Under this smart appearance is a rugged steel structure. At the peak and knee, the continuously welded Rigid Frame I-section steel plate beams are securely bolted together. The frame is designed to put the assembly bolts primarily in *shear* rather than *tension*. At the foundation, each column is permanently bolted. Stran-Steel Rigid Frame buildings are clear-span structures available in widths of 40, 50, 60, 70, and 80 feet, and multiples thereof.

Unlimited design possibilities make these buildings ideal for warehouses, factories, retail or service centers. Fast, accurate assembly is made possible by precision punching and die forming. You get the cost-saving features of a pre-engineered structure in a quality building which is durable, fire-safe, easy to insulate and easy to heat.

For complete engineering details, call your local Stran-Steel dealer or send for the new Industrial Buildings Catalog.

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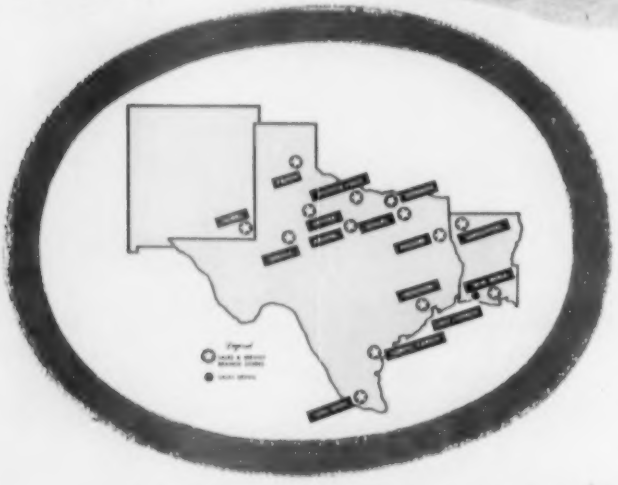
. . . the Waukesha Sales & Service, Inc., emblem on the uniform of the man from whom you buy your parts and on the truck that delivers them.

Your Waukesha engine will give its best performance **only** when fitted with genuine Waukesha parts. So always look for the Waukesha Sales & Service, Inc., emblem when you purchase replacement parts. Waukesha Sales & Service, Inc., branches and sales points, located throughout the oil country, carry complete stocks of engine parts, made to fit your engine and made to last, giving you the best possible performance from your Waukesha engine. So, remember the Waukesha Sales & Service, Inc., emblem the next time your engine needs a new part.



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WORLD'S LARGEST DISTRIBUTOR OF OIL FIELD ENGINES

Captain Shreve and Washington-Youree Hotels, Shreveport.

26 American Institute of Chemical Engineers, South Texas Section, eleventh annual technical meeting, Galvez Hotel, Galveston, Tex.

29-30 Illinois Geological Survey, Petroleum Engineering Conference on Waterflooding, University of Illinois, Urbana, Ill.

29-30 Independent Petroleum Association of America, twenty-seventh annual meeting, Statler-Hilton Hotel, Dallas.

29-31 Energy Resources Conference, sponsored by the Denver Chamber of Commerce, Denver.

29-Nov. 1 Society of Exploration Geophysicists, annual meeting, Roosevelt Hotel, New Orleans.

31-Nov. 2 Gulf Coast Association of Geological Societies, sixth annual convention, Plaza Hotel, San Antonio.

NOVEMBER

1-2 Louisiana Polytechnic Institute, fifth annual instrumentation conference, Ruston, La.

7-8 Instrument Society of America, Philadelphia Section, symposium on process data logging, Stratford Hotel, Philadelphia.

8-9 American Association of Petroleum Geologists, Society of Exploration Geophysicists, and Society of Economic Paleontologists and Mineralogists, Pacific Coast Joint Regional Meeting, Ambassador Hotel, Los Angeles.

8-9 Society of Automotive Engineers, Inc., national fuel and lubricants meeting, Mayo Hotel, Tulsa.

12-15 American Petroleum Institute, thirty-sixth annual meeting, Conrad Hilton Hotel and Palmer House, Chicago.

19-20 American Institute of Mining, Metallurgical & Petroleum Engineers, North Texas Secondary Recovery Symposium, Municipal Auditorium, Wichita Falls.

25-27 Kansas Independent Oil and Gas Association, nineteenth annual meeting, Broadview Hotel, Wichita.

25-30 American Society of Mechanical Engineers, Statler Hotel, New York.

30 Natural Gasoline Association of America, Panhandle-Plains regional meeting, Herring Hotel, Amarillo, Tex.

29-Dec. 1 Interstate Oil Compact Commission, annual meeting, Allis Hotel, Wichita.

DECEMBER

3-4 New Mexico Oil and Gas Association, annual meeting, Alvarado Hotel, Albuquerque.

9-12 American Institute of Chemical Engineers, annual meeting, Statler Hotel, Boston.

1957

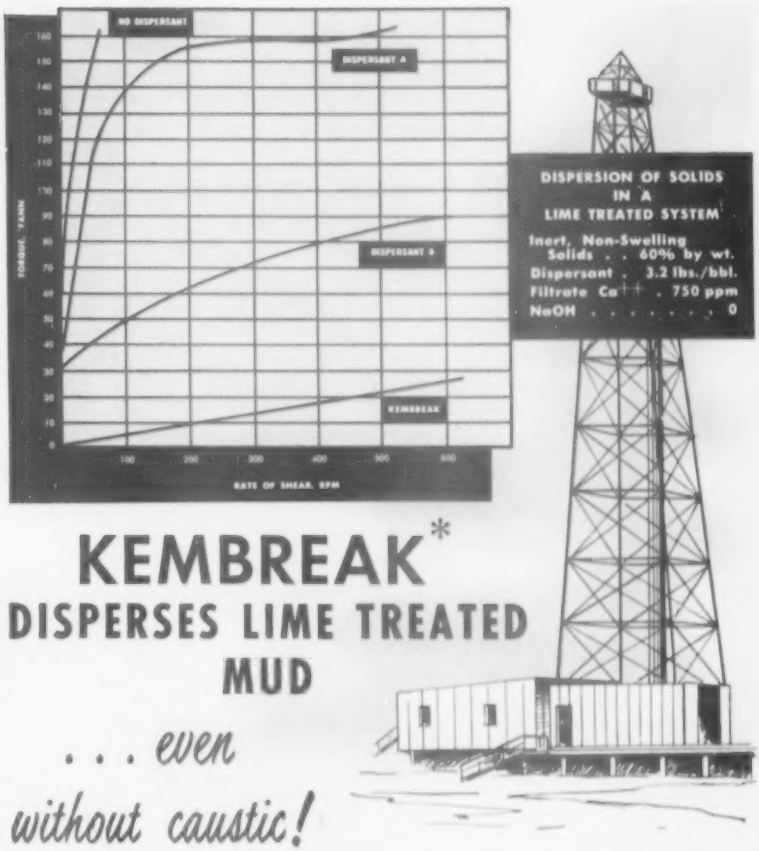
JANUARY

14-16 Pipe Line Contractors Association ninth annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

21-55 American Institute of Electrical Engineers, 1957 winter general meeting, Hotel Statler, New York City.

FEBRUARY

22 Natural Gasoline Association of America, Permian basin regional meeting, Scharbauer Hotel, Midland, Tex.


NO DISPERSANT
DISPERSANT A
DISPERSANT B
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TORQUE, YANN
RATE OF SHEAR, RPM
DISPERSION OF SOLIDS IN A LIME TREATED SYSTEM
Inert, Non-Swelling Solids . . 60% by wt.
Dispersant . 3.2 lbs./bbl.
Filtrate Ca++ . 750 ppm
NaOH 0

KEMBREAK* DISPERSES LIME TREATED MUD

. . . even without caustic!

The "mud" used to develop the curves shown here is not one you'd want to use for making hole. But in the laboratory it is one means of demonstrating how well KEMBREAK disperses a mud system having a high calcium ion concentration—without the addition of caustic. And, of course, this dispersant performs equally well in low lime—low caustic drilling fluids and conventional lime base muds.

Furthermore, KEMBREAK muds are virtually unaffected by the contaminants encountered in normal drilling, e.g.: gypsum, anhydrite, cement, salt, lime, limey shales, and clay. KEMBREAK is a stabilizer, too, for oil-in-water emulsions . . . making it doubly useful in lime treated emulsion muds.

Guard against drilling failures, whenever difficult hole conditions are expected, by using muds made with KEMBREAK.

KEMBREAK is a trade name for Marathon Corporation's neutral calcium lignosulfonate. It is the only lignosulfonate product proved by years of successful use in oil well drilling.

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may be obtained from
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HOUSTON, TEXAS
MILWHITE MUD SALES CO.
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*REG. T.M. ACCUBRACE RIG TOOL CO.

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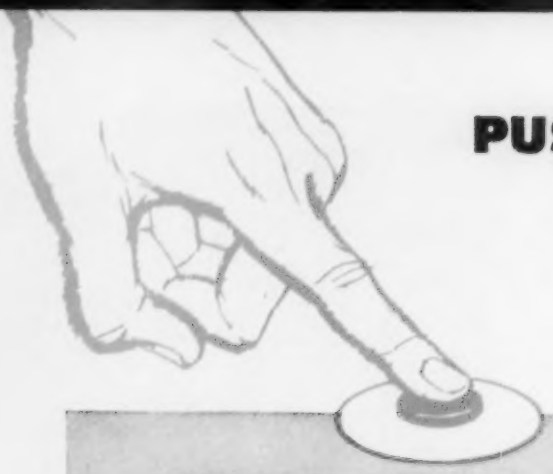
ROTHSCHILD • WISCONSIN

PUSH-BUTTON CONTROL

...typical of advanced design in the favorite of the world's oilfields...



THE RUGGED EMSCO GC-500 RIG

(500 to 700 hp)

ADVANCED DESIGN ASSURES YOU:

- EFFICIENT LUBRICATION SYSTEM
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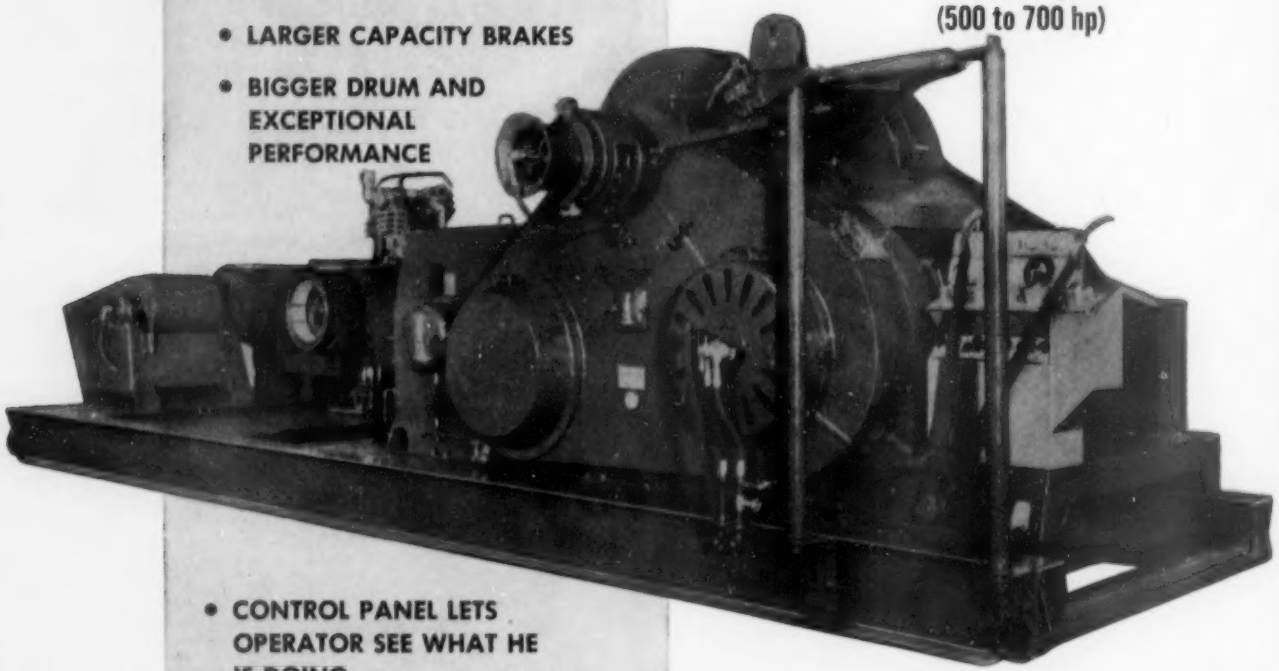

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JOURNALLY SPEAKING . . .

ICE CORE from Greenland well. At extreme left is a core lifter, and just to its right, the special core bit developed for the ice project.

Cold Coring

COMES that time of year when we are preparing to shove off on vacation and have to get some copy out in advance so we can sneak away early. Writing a column is tough enough when right up against a deadline, but writing a couple of extras in advance is unspeakably worse.

So we dig through that bottom drawer where all year we have stuffed notes and clippings about off-beat and odd-ball happenings. When really desperate for an idea, sometimes we can wangle an angle out of one of them.

Here's a couple of clips about core drilling, and—what do you know—they can be tied together because they're both about cold coring.

The first is from George E. Failing Co., which makes rigs for the industry and hopes to make publicity for itself. This blurb (duly cleared for security by the Department of Defense) relates that a core drill (guess whose) has been flown to Greenland by the U. S. Army Engineers. Hunting for oil? Not at all. It's going to make ice cubes out of Greenland's icy mountains.

The operation has something to do with the International Geophysical Year, which is something that is intriguing long-haired scientists all over the world. Using specially designed bits, core barrels, and core lifters, developed by a certain manufacturer whose name won't be repeated for fear this column will read like an ad, the Army Engineers are going to find out what the ice is like several thousand feet deep and how cold it is down there. (Don't ask us what good that will do.)

For the benefit of the technically minded we might add that drilling is done by air at 100 psi. which is passed through a heat exchanger which lowers temperature to "ambient-plus-10 degrees" (whatever that means). Then it's dried and cooled some more, because the air has to be the same temperature as the hole.

The other item about cold coring comes from Standard Oil Co. (Ind.). (This company doesn't sell rigs, but since we mentioned one outfit's name we ought to be impartial.) It discovered that a uranium mining operation out in a remote area of Wyoming was using large quantities of its brand of diesel oil, not only for running engines but also for coring the earth to block out ore deposits.

How is diesel oil used in coring? As a drilling fluid? To lubricate the cores? You'd never guess.

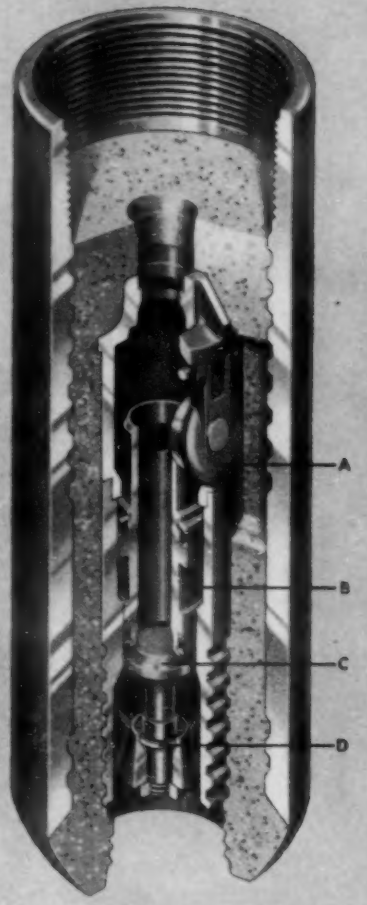
This miner's problem is how to recover a core for analysis when the uranium-bearing ore is about as soft and crumbly as ordinary dirt. So he freezes it with diesel oil. He mixes chunks of dry ice in a big tank of diesel oil until he gets it to 10 degrees below zero. Then he pumps it down the hole and freezes core, barrel, and all.

As soon as the core barrel gets to the surface the Wyoming sun releases the core, and it soon thaws into a pile of loose earth to be sacked and sent off for analysis. Apparently the lab isn't bothered about this kind of an oil-stained core. Pretty slick idea, eh? What will people think of next!

Further coring through our bottom drawer brings up a miscellany of trivia which is all entirely too cold to be of any use. Not a hot idea in any of it.

Except perhaps this one about the oblivion cocktail. Just what we need at this moment. Think we'll rush right out and get one. An oblivion cocktail? Two parts Pepsi-Cola and one part Energine. It not only hits the spot but wipes it out.

—*Henry D. Ralph.*



A Flapper Type Back-Pressure Valve activated at option of operator.

B Sleeve Valve } Control rate of flow and volume of fill-up fluid.

C Sleeve Valve Seat }

D When operator shears this Shear Ring (1,000 psi on casing), Flapper Valve is released to form a Back-Pressure Valve for floating or cementing.

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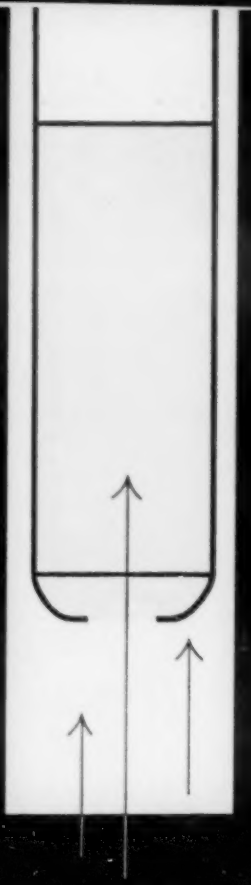
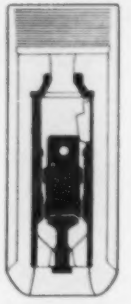


It fills casing from the bottom up

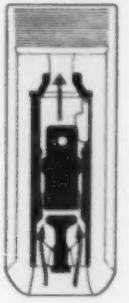
With Baker DIFFERENTIAL FILL-UP Shoes and Collars, casing is filled automatically from the bottom up, *while it is being run* . . . and because DIFFERENTIAL Equipment contains a Variable Valve *that opens and closes* to synchronize the rate of "fill" with the rate of lowering the casing, maximum reduction of destructive high-pressure surges is obtained.

This "controlled automatic fill" saves up to one-third of running-in time because . . . (a) time-wasting surface filling of casing is eliminated; and (b) casing can be run in at a faster speed, reducing the possibility of sticking, without causing destructive high-pressure surges. Pressure surges over 5000 psi can be created below casing equipped with floating equipment each time a joint is lowered. Damage caused by these high-pressure surges and the cost of this damage in bad cement jobs, lost circulation, and decreased production is becoming a matter of concern to many operators.

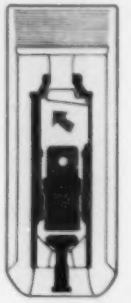
HOW DIFFERENTIAL EQUIPMENT WORKS



RUNNING-IN
Sleeve Valve in closed position



RUNNING-IN
Sleeve Valve in opened position



CEMENTING OR FLOATING
Flapper Valve released

Hydrostatic pressure of the "fill" acts on the upper pressure area of the sleeve valve. Hydrostatic pressure of the fluid in the annulus acts on the lower pressure area of the valve which is 90% of the upper pressure area. It is this differential in area that results in a "fill" of approximately 90% (shoe or collar), or 81% (shoe and collar) with respect to the fluid level of the annulus and gives the equipment its name. The valve opens and closes in accordance with the pressure differential across it to: (1) fill the casing automatically, (2) reduce pressure surges and (3) prevent overfill of the casing.

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The tidelands and "due process of law"

LEGAL red tape and petty politics are costing offshore oil operators uncounted thousands of dollars daily.

In this summer's skirmish over ownership of disputed tidelands both the U. S. Department of Interior and the State of Louisiana have violated their contracts with purchasers of leases under the Gulf of Mexico.

Instead of settling the basic issues involved in the dispute, the U. S. Supreme Court last June ordered a temporary ban on the drilling of new wells in the area where jurisdictional claims of the two governmental agencies overlap. Having accomplished their judicial buck passing, honorable members of the nation's highest tribunal locked up court and took off for a 3½-month vacation.

BUT THE U. S. SUPREME COURT is not solely responsible for the connivance that has gone on during its long recess—far from it.

The court left one loophole in its antidrilling order. It provided that drilling (and even leasing) might resume in the disputed area in event of a mutual agreement by the two government agencies.

So far, no such agreement has been reached. As a result, operators are forbidden to drill on some of the most promising offshore leases. One company has been barred from drilling on a disputed lease even though it has paid rental to both state and federal governments. The company claims it is paying a drilling contractor $4,400 a day while waiting for a drilling permit. To further aggravate the issue, the lease is scheduled to expire soon because of the company's failure to drill.

The same agencies which sold questionable leases are now preventing leaseholders from drilling on them.

The U. S. took a far different stand when Mexican gunboats recently seized a few American shrimp trawlers near Mexico's border. Cries of "piracy" rang through Washington, and soon the Coast Guard increased the size of its fleet in the western gulf.

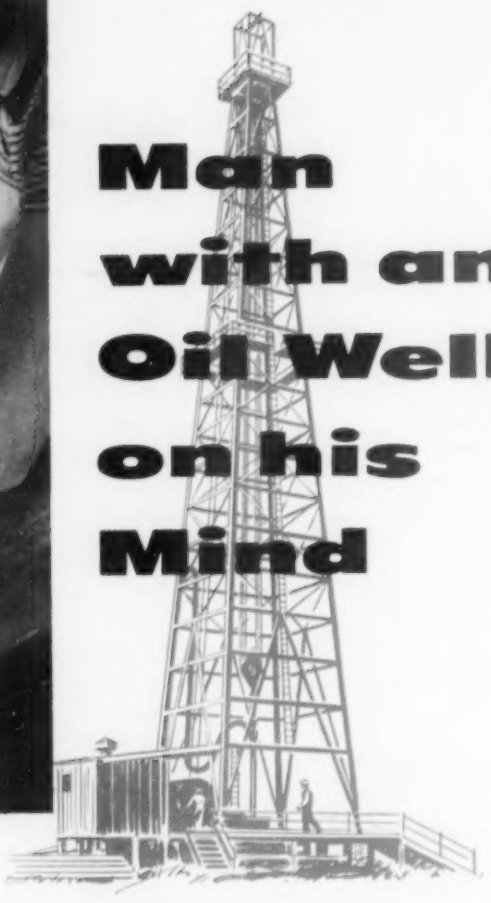
THIS DRAMATIC ACTION was taken to protect the rights of shrimpers in international waters. Yet the shrimpers have paid nothing for gulf "leases," and some of their boats apparently were much closer to Mexico's shores than are many of the shutdown rigs to the U. S. mainland.

Again, the U. S. intervened when a little dictator seized a big canal on the other side of the globe. The canal, it seems, is vital because foreign oil flows through it.

Officials in Washington and elsewhere will tell you that foreign oil must be protected because this country's reserves are not keeping pace with its expanding needs. And yet, Louisiana and the U. S. are deliberately blocking development of what may be one of the country's greatest oil reserves of the future.

The federal Constitution has a beautiful phrase about "due process of law." Offshore oil operators are wondering when the process will begin.

Man with an Oil Well on his Mind



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Current and significant in . . .

The Industry This Week

Exploration

• **Union Oil Co. finally has hit in Costa Rica.** Its fifth wildcat came in a producer, giving Central America its first oil production and touching off feverish interest in Costa Rican and Panamanian concessions. P. 96.

River of oil is still flowing from Iran's runaway wildcat. While experts gather equipment to cap the wild well, 80,000 to 150,000 bbl. daily is blowing over the derrick. P. 98.

Venezuela's president wasn't fooling when he called for special favors in bids on Lake Maracaibo concessions. He got one royalty bid of one-fourth instead of the usual one-sixth, gifts of $500,000 and a sizable volume of gas, and free geophysical surveys of an area to be selected by the government. P. 99.

Drilling

• **Russian turbodrills may still reach the U. S.** Reports from Washington say Dresser Industries has made a new deal with Soviets to bring the drill to this country. P. 87.

Louisiana has approved general terms of compromise which would permit offshore drilling to be resumed in disputed tidelands. But major issues still are to be ironed out between state and federal governments. P. 87.

Processing

• **Refiners are taking in stride** the word from Detroit that 1957 autos again will have higher-compression, bigger-horsepower engines. They are ready to meet any demands expected from new models. P. 78.

Refinery construction is mushrooming in the Pacific Northwest. Standard of California plans to start work on 60,000-bbl. plant near Everett, Wash., next year. Others now building or planned will boost runs in region more than 185,000 bbl. within next two years. P. 90.

Split is widening among marketers whether to add third-grade super-premium gasoline. Cities Service joins those adding third grade. Indiana Standard will stand pat on two grades. P. 91.

Pipelining

• **A major crude-oil pipeline** from the Four Corners area to California processing centers is in the mill. Behind the move are California refiners and Rocky Mountain oil producers. P. 83.

Battle over Midwestern Gas Transmission's project to import Canadian gas through opposing markets may come to a head before FPC examiner this week. P. 91.

Conversion of old crude line in West Texas to L.P.G. service is proving profitable venture for Magnolia. Company now is planning to expand line. P. 82.

Production

• **A new fracturing technique using rubber balls** gives a more complete fracture of some wells with zones of varying permeability. The balls seal the section which opens up first and diverts fluid into tighter zones. Other advantages: Less cost and time. P. 86.

Latest estimates rank Citronelle as one of the nation's most important discoveries since East Texas. Crude reserves are estimated by Alabama officials at 150 million barrels. P. 85.

Box Score on Superpremium Gasolines

Company	Where Available	When	Est. Octane	Price	Future Plans
		THIRD GRADES			
Sun Oil Co.	Florida, South Georgia	Now	100+ *	Reg. 5¢	To be announced late this fall
Esso Standard Oil Co.	Maine to Louisiana	Now	100+	Premium plus 3¢	
Humble Oil & Refining Co.	Principal Texas cities	Now	100+	Premium plus 3¢	More of Texas plus Southeast New Mexico later
Standard Oil Co. of Ky.	Kentucky, Mississippi, Alabama, Georgia & Florida	Now	100+	Premium plus 3¢	
Continental Oil Co.	Houston area	Now	100+	Premium plus 3¢	Experimental. No future plans announced.
Watson Oil Co. Ltd.†	Gulf Coast	Now	?	Premium plus 1-3¢	
Texas Petroleum Co.†	Houston	Now	?	Premium plus 3¢	
Cities Service Oil Co.	15 selected East and Gulf Coast cities	Early Oct.	100+	Premium plus 3¢	No announced plans on expanding to inland markets.
		HIGHER PREMIUM GRADES			
Shell Oil Co.	East & Gulf Coast	Now	99+	Premium plus 1¢	No plans on extending to inland or West Coast markets.
Sinclair Refining Co.	37 states not including New England, Montana & West Coast	Now	99+	Premium plus 1¢	

* Top grade of five † Independent marketers, supplied by Eastern States Petroleum Co.

Refiners Are Ready for the '57 Cars

● It's the same old tune from Detroit: More horsepower, higher compression. But gasolines have improved so much over the past year there'll be no problem.

George Weber
Refining Editor

NEW YORK.—The annual autumn guessing-game on the octane appetites of next year's autos is now in full swing.

Again it's the same old story from Detroit: Higher compression ratios, more horsepower, and maybe a token offering of fuel injection.

But the gasoline picture is different. The oil industry this year seems solidly primed for anything the new 1957 models will need on octane. Here's its defense:

. . . **Regular** grade quality is up 1½ octane numbers from a year ago.

. . . **Premium** has risen a full research number.

. . . **Superpremium** third grade and beefed-up premium brands have become a key factor. They are now available throughout much of the country. And it appears that nation-wide distribution of the higher quality fuels will be available by the time they are needed for next year's souped-up models.

What's Detroit up to? . . . The word from Detroit still carries a punch for refiners, however. The trends stack up like this:

. . . **Compression ratios** are going to continue upward in the 1957 models. On the average the rise will be about 0.4 to 0.5 of a compression ratio—from the 1956 average of 8.55:1 to 9:1 or higher.

Much of the over-all increase will come from car makers who lagged the field this year. They underestimated what they could get by with and are in a hurry to catch up. Hence, octane requirements will be boosted chiefly in the middle ranges. Gasoline quality needed to satisfy 50, 60, and 70 per cent of 1957 models will jump more than the octane needs for the high requirement models in the 90-95 per cent range.

. . . **The horsepower** race also will continue. New models may average 12 to 15 per cent higher in maximum advertised horsepower.

This boost will take place all along the line. Some of the low-priced economy models will remain, but low-priced cars offering less than 200 hp. will be fewer in number next year. There will be a general movement among the medium-priced class toward the 300 figure. At the top the luxury models which hovered around 300 in 1956 will break through toward 350.

. . . **Fuel injection** is expected to appear on the scene. But it will be on an optional basis for a very few specialty models. This isn't the year for fuel injection to make a very deep

bow. Too many technical difficulties still stand in the way of its mass application in 1957.

. . . **Styling** will be lower and longer. The smaller wheels on most models will permit hand-shaking across the tops of several new cars. Wrap-around windshields are going to wrap around still more into the top. Out-flaring fenders will tempt the buyer.

. . . **Gas turbine** is not yet in sight. But it is barely possible that 1958 or 1959 may see a limited U. S. production of a diesel-powered car.

Detroit's thinking . . . The auto industry has a bright green light for these progressive steps.

In viewing the octane picture, present and future, engine designers feel confident in boosting the appetites of their new production models. Some quarters feel that 1957 may well be the last year for the headlong horsepower race, and look for a slackening in engine-output gains for 1958.

But this concept is not echoed in Detroit. During hearings last week held by the House subcommittee on highway safety, congressmen were regaled with a continuous string of demonstrations aimed at proving that greater horsepower is a telling safety requirement.

Tricky octanes . . . The 1957 rise in compression ratios and horsepower at first blush would appear to overtax refiners' ability to keep up.

The needs, as reflected in the accompanying map, shape up like this. Some 70 per cent of all 1956 cars are satisfied with a fuel of just less than 94 research octane number. The same segment of 1957 models will need about 95 RON.

On the high-equipment side, an increase of about 0.5 RON is in the books. A rule of thumb calls for an increase in net requirement of about 10 performance numbers for each unit rise in compression ratio. This would indicate a 1957 need for 5 more performance numbers or 1½ to 2 more RON.

The weighted national averages for premium and regular grades of gasoline now stand at 97.0 and 90.1 RON, respectively. In relating these current octanes to 1957 requirements, it would appear that today's premium gasoline would satisfy well over 95 per cent of all cars on the road next year. But it would satisfy only 85-90 per cent of 1957 models.

But this is a false conception. Estimated car needs are measured at low altitudes, near sea level. This is true even for measuring higher-octane requirements resulting from engine deposition. At higher altitudes, cars need less octane to prevent knocking.

Therefore, the national octane picture as conventionally surveyed is not the picture Detroit uses when planning new models. Car owners view current and projected gasoline quality from another standpoint: How well will the fuel satisfy new cars in geographic regions where the cars will be operated?

The picture Detroit sees is shown in the map. It depicts how car requirements are being met now with average premium grades sold in August. This map equates actual research-octane values to sea level, employing the altitude of the respective marketing regions.

Roughly at the 97-RON level, requirements of a car will drop one full number for each gain of 1,000 ft. in altitude. The values plotted on the map were derived by a more precise correlation. They do not show octanes, but quality which will satisfy cars of varying octane requirements.

Any trouble spots? This engine's-eye-view of today's premium gasoline changes some general conceptions on possible trouble spots.

On the basis of average premium grade it shows relatively few serious low-octane areas. In general, Detroit views the upper Mississippi Valley and the West Coast as the limiting areas on octane availability.

The Panhandle - West Texas - New

How "Hot Car" Needs Are Being Met
100+
99 - 100
98 - 99
97 - 98
96 - 97
A car requiring the octane rating shown in any area can be satisfied by the average premium gasoline sold in that area

Mexico region is not commonly considered to a be a high-octane area. It falls below the national average on premium ratings. But because of elevation, it is today meeting the needs of cars with requirements exceeding 100 RON. Similarly the altitude factor puts much of Wyoming and Colorado in the position of satisfying 99-octane requirement cars. Cars with 98-octane appetites should get along well in the Northwest intermountain region, the Southeast, and through the western sections of New York and Pennsylvania. The remainder of the country, except for the northern plains and the low-level Pacific Coast will adequately take care of all 97-octane requirement cars.

This relationship shows that octanes, as they are used, are fairly uniform throughout the country.

Bear in mind that this map reflects average premium octanes available now. In every area, certain brands will rate from a few tenths to more than one octane higher than the arithmetical average.

If car owners were to shop around and find the best available this summer, they would find they could satisfy their 100-octane requirement cars throughout most of the southern Rockies. Cars knocking on less than 99 would get by on selected premium brands in most of the western mountains, inland Texas, upper Michigan, Mississippi, and western New York and Pennsylvania. The equivalent of 98 octane can be found in the rest of the country excepting for the upper Mississippi Valley and the Pacific coastal strip. North Dakota remains an isolated spot, satisfying only those cars with 96-octane requirements or less.

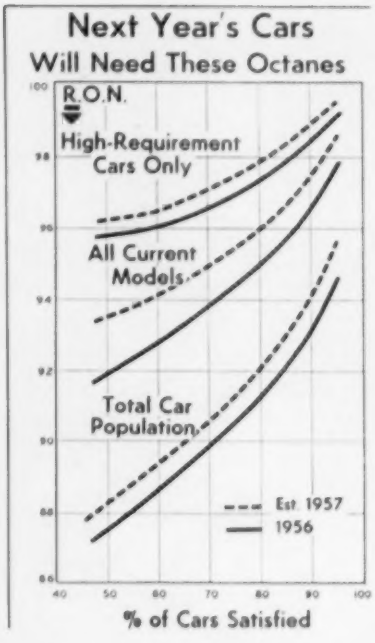
The superpremiums . . . This is not the whole story. Drivers of new "hot" cars will find the recently introduced superpremiums will end antiknock trouble in much of the nation.

The picture today on actual octane ratings is shown in the second map. From Maine to New Mexico, motorists can now fill up at third-grade, superpremium pumps vending gasoline of over 100 RON. In most neighborhoods of these 24 states they will find this grade marketed by Esso Standard Oil Co., Standard Oil Co. of Kentucky, and Humble Oil & Refining Co. Cities Service Oil Co. will start a third grade next month.

Sun Oil Co. offers five grades including a 100-plus octane top grade in Florida and southern Georgia. Continental Oil Co. is test-marketing a superpremium estimated at 100 octane or better in sections of the Texas Gulf Coast.

In addition to these third and multiple grades, two other major oil companies are launching a beefed-up premium which is expected to rate at the 99-RON level. Shell Oil Co. will have its new superpremium available throughout the Gulf Coast and Eastern Seaboard by November. This week, Sinclair Refining Co. will be selling a superpremium containing a new additive throughout its 37-state marketing area.

For the present, this gives the equivalent of 99 RON or better to all but six western states. When altitude is taken into consideration, it is probable that 100-octane requirement cars will be satisfied over most of the nation this fall.



More coming . . . What the picture will be next spring is now the subject of hot conjecture. Several major oil companies who together blanket the nation on marketing, have yet to state their positions on third-grade vs. souped-up premium.

At this stage, adoption of the third grade has not caught on as expected in early summer. Four majors, Sinclair, Shell, Indiana Standard, and Socony-Mobil, have announced they will not follow this line. There remains such majors as The Texas Co., Gulf Oil Corp., and Standard Oil Co. of California who have not yet tipped their hands on which route they will follow. Some of these are understood to be high on the third grade.

While it is fruitless to guess what these closely held plans will spell out, it is generally conceded that by spring 99-RON gasoline or better will be available to the nation as a whole.

For the present, some companies in both the automotive and oil industries are playing a waiting game. Car manufacturers can wait a little longer before settling on their compression ratios to take advantage of any possible moves which would give them more latitude.

On the other hand, some oil companies may decide to wait until early next year when the requirement picture on 1957 models is clarified.

Octanes can rise . . . The industry has the potential for adding to premium ratings, and moving upward across the board. Some cushion remains for higher-severity reforming, and new cat reforming capacity is still going at a rapid rate.

Catalytic reforming capacity stood at 1,059,000 bbl. per stream day July 1. This represents 11.6 per cent of crude capacity. By January 1, 1957, cat reforming capacity amounting to 1,276,000 bbl. per day will be on stream. One year hence the total will be over 1,400,000. The total will approach 1,600,000 bbl. per day by early 1958. This will boost catalytic reforming capacity to about 16.0 per cent on crude.

For the refiner with catalytic cracking and reforming, plus some alkylation, a 100-plus octane superpremium is no great problem if it represents 15 per cent of his total gallonage. The conventional blend today comprises light cat cracked stock, heavy reformate, some alkylate plus light ends for volatility, and tetraethyl lead. It appears that the market for third grade superpremium may level off at about 15 per cent or less.

Esso started out with a Golden Esso Extra demand representing 22 per cent in the six test stations first supplied with the third grade. As the grade became more widely available and the novelty wore off, this market declined as expected, to between 12 and 15 per cent. Even that is more than was anticipated, since the new grade was tailored to meet the requirements of about 5 per cent of the market.

Trend is healthy . . . Regardless of whether the industry swings to a third grade or a higher premium, the move is considered a healthy one.

Throughout the past several years of rising octanes there has been a strong sentiment for increasing both the octane and price spread between regular and premium grades. This year's move does just that. It adjusts the price load in the right direction, toward a higher realization from the users of high requirement cars.

For the present at least, service station prices on high grades are consid-

ered to be roughly in line with quality vended. The 100-plus third grades are getting 3 cents per gallon over premium. Sun's multigrade system is based on regular grade price for the conventional single grade rated about midway between average regular and premium octane. A 1-cent spread is applied to the next three grades and top grade jumps 2 cents. The superpremium grades which replace premium are going for 1 cent extra per gallon.

While none of the majors offering these higher-quality grades is talking octane ratings, it is generally conceded that the two grade systems top off at about 99.0 to 99.3 RON and the third grades are kept at about 100.5 RON. These will vary within the normal range of error in blending and distribution.

In most of the areas where these higher-octane fuels are now being marketed, premium stands close to 97.5 RON. The 1-cent spread for the 1½ octane bonus to 99 plus is considered roughly equivalent to the 3-cent spread asked for 100-plus, because the research octane number from 99 to 100 is much greater than the next lower increment.

If the present price spread holds, it is considered a fair return, based on over-all costs. Many refiners find that cost per octane-barrel has been lower than anticipated, due to expanding markets. If there is any rule-of-thumb rating on cost, it is believed to be about 0.4 cent per gallon per RON in the 97-99 octane range. To this must be added a substantial charge-off for distribution, retailing, advertising.

What of 1958? . . . In view of the probable nation-wide distribution of superpremium gasoline, Detroit's expected move in 1957 might seem moderate. While several models will reach the 10:1 compression ratio, few if any are expected to exceed that level next year. Actually, Packard which initially went to 10:1 in 1956, backed off to 9.7:1 when faced with difficulty in finding sufficient octanes.

While it appears that refiners will be in a good position on octane when the 1957 models reach their equilibrium requirements early next year, the industry may face more pressure one year hence. With some areas excepted, refiners have outstripped the needs of a vast majority of cars today and next year. Engine designers, while highly interested in the superpremium trend, cannot now anticipate with certainty that 99-100 plus fuels will be available everywhere next spring.

But if the swing to these high-quality grades continues as now indicated, watch out for 1958.

Processing BRIEFS

WASHINGTON.—Results of the Air Force's petroleum research and development during the year ended June 30, 1955 are now being made available to refiners through the Commerce Department.

Abstracts of reports on 205 studies of oil products, rubber, and other materials have been combined in a 137-page book, PB 111648S. Copies may be ordered from the Office of Technical Services at $3.50 each. The department also has similar compilations of reports on Air Force Research over 10 years prior to July 1, 1953 (PB 111537, $3.75) and for the fiscal year ended June 30, 1954 (PB 111648, $2.75).

WILMINGTON.—The Du Pont Co. plans to build a $2 million radiation physics laboratory at its experimental station here. The new building will have electrical equipment to generate a variety of high-energy, atomic-type particles and rays. A staff of radiation specialists primarily will study the effect of radiation on reactions involved in chemical manufacture. They will supply fundamental data for various departments of the company. Work will start immediately with completion expected early in 1958.

NEW YORK.—Nine more independent refiners have joined the fight to block the sale of Universal Oil Products Co. with motions to intervene before the New York Supreme Court.

They are Pennzoil Division of South Penn Oil Co.; Elk Refining Co., Charleston, W. Va.; Quaker Oil Refining Corp., Oil City, Pa.; Rock Island Refining Corp., Indianapolis, Ind.; United Refining Co., Warren, Pa.; Kendall Refining Co., Bradford, Pa.; Vickers Petroleum Co., Inc., Wichita, Kans.; National Cooperative Refinery Association of Wichita; and Great Northern Oil Co., St. Paul, Minn. A hearing on the protests will be held September 11.

NEW YORK.—A complete fire-protection program for natural-gasoline operations has been detailed in a new manual, "Fire Protection in Natural-Gasoline Plants." It's obtainable at American Petroleum Institute headquarters here.

PENSACOLA, Fla.—American Cyanamid Co. has decided to locate its Creslan plant in Santa Rosa County, across Escambia Bay from here. The new synthetic acrylic fiber recently introduced by the company will be based on acrylonitrile from Cyanamid's petrochemical plant at Fortier, La. Design of the original plant will permit doubling the initial capacity of 27 million pounds of fiber per year.

NEWARK, N. J.—Esso Research & Engineering Co. has leased an unused paved strip at Newark Airport for a test car roadway. The area, 50 ft. wide and ¾ mile long, will be used for acceleration tests of experimental fuels and lubricants.

NEW YORK.—Shell Chemical Co. has reduced the price of synthetic glycerin by 2 cents per pound, to 28 cents per pound in tank car lots. Shell is the largest glycerin producer, making the chemical from petroleum fractions at Houston.

Also for Refiners . . .

Car manufacturers will place a bigger demand on refiners with their octane-hungry 1957 models. But the gasoline industry is geared to handle any demands expected from Detroit (P. 78) . . . Latest Ethyl survey shows octanes have been steady for 3 months (P. 82) . . . Standard of California will start building a 60,000-bbl. refinery near Everett, Wash., next year . . . Sinclair will probe into how radiation affects various refining processes . . . Texas Railroad Commission places part of enforcement responsibility for gas flaring on natural-gasoline plant operators (P. 90) . . . Cities Service plans to add third grade, Standard of Indiana will stick to two grades (P. 91) . . . Shell expands Martinez plant to start production of a new fuel-oil additive and step up production of ethel amyl ketone (P. 92) . . .

Plus these features:

How to design and maintain flexible pipe joints—fourth in a series on maintaining the cat cracker (P. 108) . . . Petrochemicals output in the United Kingdom due to increase 67 per cent by 1958 (P. 111) . . . Recovering ethylene by various methods—No. 6 in a series on making ethylene (P. 113) . . . Use of steam in distillation to get a higher flash of overhead product (P. 141) . . . Factors governing success of midget gasoline plants (P. 145) . . . Tips on painting steel to insure adequate protection (P. 147) . . . And how to estimate total costs of installed instruments (P. 149).

L.P.G. Line Pays Off

Magnolia's switch from crude to light products has been so successful it plans to boost capacity to 20,000 bbl.

DALLAS.—Magnolia Petroleum Co.'s conversion early this year of an old 8 and 10-in. crude line from West Texas to the Gulf Coast to L.P.G. service looks more and more like a very good business venture.

This became apparent last week when the company revealed new details of its plans for expanding the line and adding new field-processing plants to its supply sources.

The line originally was one of Magnolia's oldest in Texas. It extends from Midland to the Beaumont refining area. But the system was in need of reconditioning. Along with that, economics of crude movement no longer favored bringing oil over such a long distance through such a small-diameter line.

Magnolia last year laid a new and larger crude line. It more than takes care of the throughput handled by the old line. Then last summer the company started work to convert the 8-in. line to L.P.G. service.

Work and testing was completed early this year, and the line delivered its first butane to Beaumont in March. Throughput initially was only about 6,600 bbl. daily, with products coming from just two plants. These were El Paso Natural Gas Co.'s big Midkiff plant in the Spraberry (about 3,600 bbl.) and the Magnolia-operated plant in Pegasus field south of Midland.

Throughput hiked . . . Since then, the company has steadily increased throughput to about 15,000 bbl. daily by connecting more natural-gasoline plants along the route.

In addition to the first two plants, it now takes products from El Paso's Grimes plant near Sweetwater and from two plants in Scurry County . . . one in Kelly-Snyder field and one in Diamond "M" field.

New laterals planned . . . Throughput will be boosted still further to between 18,000 and 20,000 bbl. daily via construction planned for the immediate future.

The company plans to lay a new 36-mile 12-in. crude line from Midland to Andrews, Tex., immediately. When the crude line is completed, the company will convert an existing 8-in. crude line between these two points to L.P.G. service.

Meanwhile, it will lay about 30 miles of 8-in. from Andrews southwest to near Dollarhide field in extreme southwestern Andrews County, then 4-in. from Dollarhide across the New Mexico line to the vicinity of Jal in Lea County.

This line will take products from El Paso Natural's Jal Nos. 1 and 4 gasoline plants. A connection probably will be made later with Pure Oil Co.'s plant in Dollarhide field.

The company will lay still another line from a connection with the main trunk at Sweetwater to pick up products from Nolan and Coke counties.

This lateral, a 32-mile, 4-in. carrier, will take products from an El Paso Natural plant in Nolan County, then continue on south to Jameson field in Coke County to tap production of Texas Natural Gasoline Corp.'s Perkins plant there.

All this construction is slated for completion by the first of January.

The additional products from this work will require an expansion of pump-station capacity along the line. The main line now has pump stations at Midland and De Leon. Current line capacity is about 17,000 bbl.

The company expects to decide soon where it will add pump capacity and to start this work too.

Alberta's Allowable Dips

CALGARY.—A crude-oil production allowable of 421,931 bbl. daily has been authorized for September by the Alberta Petroleum and Natural Gas Conservation Board.

The allowable is 26,767 bbl. daily below the record 448,698 bbl. set for August. Pembina field will account for about one-fourth of the month's production with a 106,024-bbl. daily allowable. Other large allowables include Redwater 76,990 bbl., and Leduc-Woodbend 57,370 bbl.

Cremona Line Nears Opening

CALGARY. — Oil is expected to begin moving next week through the Cremona pipeline to Calgary refineries. The line runs from the Sundre, Westward Ho, and Harmattan fields of South Central Alberta.

Initial flow is estimated at 7,000 bbl. daily, three times the amount first estimated. This increase reflects heightened development in the fields served by the line. Initial capacity of the line will be 18,000 bbl. daily.

Dutton-Williams Brothers, Ltd., contractors, have completed construction of the 68-mile, 8⅝-in. crude line. Crews are now linking it with the Calgary refineries of Imperial Oil, Ltd., and British American Oil Co. Testing has already begun and filling will start soon. It will hold 25,000 bbl. and filling is expected to be completed by September 15.

Cremona is a subsidiary of Home Oil Co., Ltd.

Octanes Steady

August level is unchanged from average of last June

NEW YORK. — Octanes have held steady across the country the past 3 months, according to the August monthly survey conducted by Ethyl Corp.

The weighted average on premium-grade gasoline stood at 97.0 research-octane number, up 0.1 number from July and unchanged from the June level.

Regular grade showed an average of 90.1 research-octane number, unchanged from July. Ethyl is not including third grade superpremium or multigrade brands in its current surveys. But the new improved premium brands being introduced on the Gulf and East Coasts will be weighted in.

The following shows the distribution of premium and regular octane averages obtained in 53 cities throughout the U. S.:

PREMIUM

	Aug. 1956	July 1956	Aug. 1955
90-90.9	0	0	10
91-91.9	0	0	1
92-92.9	0	1	1
93-93.9	2	1	4
94-94.9	2	2	11
95-95.9	1	3	13
96-96.9	21	21	19
97-97.9	27	25	3
98-98.9	0	0	0
Wtd. avg. RON	97.0	96.9	95.9
Wtd. avg. TEL, ml./gal.	2.60	2.60	2.59

REGULAR

81-81.9	1	0	0
82-82.9	0	1	1
83-83.9	0	0	1
84-84.9	0	0	3
85-85.9	1	1	5
86-86.9	9	5	11
87-87.9	2	6	6
88-88.9	12	13	10
89-89.9	10	8	7
90-90.9	2	4	9
91-91.9	13	10	0
92-92.9	3	5	0
Wtd. avg. RON	90.1	90.1	88.5
Wtd. avg. TEL, ml./gal.	2.38	2.37	2.27

Crude Line Talked

Movement of Four Corners crude to California planned

LOS ANGELES.—California refiners and Rocky Mountain producers are planning a major crude-oil pipeline from the Four Corners area to California.

One meeting already has been held by representatives of several companies to explore the idea.

California refiners are currently processing about 120,000 bbl. daily more than the state's crude-oil production. Purpose of the line would be to cut the volume of foreign oil which West Coast refiners now must import. In June, for example, imports into California averaged about 111,000 bbl. daily.

Key figure in the drive for a jointly owned pipeline is Robert O. Anderson, president of both Wilshire Oil Co., a heavy importer, and Malco Refineries, Inc.

Santa Fe Railroad also is interested in the project and has offered its right-of-way for construction of the line. The railroad has indicated it would like an interest in ownership of the line.

The Four Corners area currently is the hottest exploratory area in the West.

There have been two large, important strikes this year—Aneth and Bisti-Black Rock—and several other indicated pool discoveries. As a result, exploratory activity has boomed.

Reports in the industry last week were that 20 companies had representatives at the meeting, held in Denver, to discuss the proposal.

Work Begun on L.P.G. Cavern

BEAUMONT, Tex.—Pure Oil Co. has started work on underground storage facilities for 200,000 bbl. of surplus butane produced during the summer at its Smiths Bluff refinery, Nederland, Tex.

The cavity will be in the Big Hill salt dome 25 miles southwest of the refinery. The plant will be connected with the storage facilities by a 4-in. pipeline. Surplus butane will be returned from storage during the winter for utilization at the refinery. Any excess will be offered for sale.

A cavity well has been drilled to the salt formation, which is about 1,700 ft. below the surface of the ground. When completed, the cavity is expected to be from 30 to 60 ft. in diameter and extending 2,000 ft. into the salt.

Construction of the pipeline will start about October 15. The entire project is scheduled to be completed about January 1.

watching WASHINGTON

. . . with Bertram F. Linz

Of platforms and imports . . .

IF political platforms mean anything, domestic oil producers should have no trouble next year in getting relief from imports.

Both parties support the reciprocal trade program. And both parties promise to protect domestic industry against excessive imports. Of the two, however, the Democrats have come out more strongly for such action.

The Democrats claim that reciprocal trade under their leadership was handled in a manner that recognized equities for agriculture, industry, and labor. The present administration, they say, has flagrantly disregarded these segments of our economy. Voted back into office, they would correct that situation, they promise.

The Republicans also claim they realize the need to safeguard domestic enterprises against unfair import competition. They proudly point out that they were primarily responsible for the escape clause and peril-point provisions, and promise their faithful and fast application.

But neither platform makes any reference to the national security clause, under which domestic producers are trying to get oil imports controlled. And political platforms, at best, are shaky structures.

Refiners near big goal . . .

DOMESTIC refining capacity is moving fast toward the goal of 9,000,000 bbl. daily set by the Office of Defense Mobilization for January 1, 1957.

A Bureau of Mines survey shows that capacity was at a high of 8,632,390 bbl. at the first of the year. That was 117,610 bbl. under the goal of 8,750,000 bbl. for that time and nearly a 212,000-bbl. increase over 1955. The January 1956 total included 251,589 bbl. of shutdown capacity. Some 201,835 bbl. of this was considered operable and 49,754 bbl. inoperable.

At the time of the survey, early this year, another 267,000 bbl. daily of capacity was building and further additions have since been laid out. These will bring the total close to the 9,000,000-bbl. mark. That is the least that defense officials now figure would be needed to carry us through a full mobilization. The survey also showed an additional 305,943 bbl. of cracking capacity was building.

Ninety per cent of the new capacity put in last year was in California, on the Texas Gulf, and in districts of Indiana, Illinois, and Kentucky.

Average capacity was boosted by more than 1,300 bbl. daily last year, from 25,830 to 27,145 bbl.

Trust busters may expand . . .

THE Justice Department's campaign against monopoly, often hitting at oil companies, is going to continue. It may even expand.

The antitrust division now has some 425 employes. Well over half of them are lawyers or economists. They make the initial study of every one of the 1,000 complaints received each year from businessmen and consumers.

If a quick study indicates a complaint is well based, a major field investigation is started by the Federal Bureau of Investigation or a grand jury.

Asst. Atty. Gen. Victor R. Hansen, new head of the division, says the drive is showing results. In 1954, its first year, only 35 new cases were filed. Last year the number was upped to 54. And Hansen has indicated that the get-tough policy of his predecessor, Stanley N. Barnes, will be continued.

The department also is going back over old cases to make sure that court and consent decrees are being obeyed. In the first 63 years after passage of the Sherman Act, only 17 contempt cases were brought for violation of decrees. But in the past 3 years, nine such cases have been filed.

Reconditioning crew removes old coating . . .

And primes it for a new one.

After reconditioning, the old line with a new coat will go back into the ditch.

Old Gas Line Gets First Reconditioning

EL PASO, Tex. — El Paso Natural Gas Co.'s first pipeline, one of the first all-welded steel pipelines ever laid to pipe natural gas, is taking a brief rest.

The 16-in. carrier extends 200 miles from Jal, N. M., in the Permian basin oil and gas-producing area to El Paso. It was placed in service in 1929.

This summer the 27-year-old line and a 17-year-old loop are undergoing a complete reconditioning job — the first since they were placed in service.

Recent inspections by El Paso Natural maintenance crews showed that the pipe coating was deteriorating in places and in a few spots the pipe needed replacing.

Reconditioning crews started at No. 1 compressor station on the original line, worked about 15 miles west to the top of the rimrock in the Guadalupe Mountains, then turned around and reconditioned the loop back to the compressor station. Eventually the entire line will be reconditioned.

El Paso is ditching out covering soil to within 3 in. of the pipe. Bulldozers equipped with side-booms lift the line out of the ditch and place it on wooden skids.

Cleaning and priming machines remove the old coating and apply primer coat. The line is then doped, wrapped with fiberglass and finally with heavy paper. The new coat is checked for holidays, and the pipe is purged with gas and relaid, ready again to carry Permian basin gas to El Paso.

Reserves soar in new report . . .

. . . Citronelle Upgraded

MOBILE, Ala.—Citronelle field, which has just completed its first year of production, may prove to be one of this country's most important oil discoveries since East Texas.

Proved crude reserves in Citronelle already are estimated at about 150,000,000 bbl. Dr. Walter B. Jones, Alabama state geologist and oil and gas supervisor, has forecast ultimate reserves worth at least $3 billion.

The optimistic summary and forecast were included in a report prepared by Dr. Jones for the state legislature.

If the infant Citronelle proves to be just half as good as the report indicates it might be, it will rank as one of the truly great fields on the North American Continent.

Issuance of Dr. Jones' report almost coincided with the field's first anniversary.

Oil was first noted in a drill-stem test at the discovery well August 16, 1955, Dr. Jones recalled. The field opener, Zach Brooks Drilling Co.'s 1 Donovan, was completed September 2, 1955, just a year ago last week.

Significant production . . . "It is significant that Citronelle has already produced over half a million barrels of oil," Dr. Jones told the revenue-hungry legislators.

"It is believed the field will be about 3½ miles wide and 8 to 10 miles long. There should be 200 to 300 wells when development is complete. Because of the depth to producing sands (10,850-11,500 ft.) it will probably take 3 to 5 more years to complete development of the field."

Dr. Jones did not forecast the field's ultimate reserves in barrels, but in dollars.

"Total value of oil in the field might well reach 3 billion dollars or more," he stated. "It is truly a big field and the forerunner of even bigger things."

Dr. Jones' prediction is all the more spectacular when compared with early reports drifting out of Mobile County shortly after oil was discovered on the big anticline. Then, geologists conceded Citronelle was a good field "for that part of the country."

Estimates revised . . . But in recent months geologists have reassessed the discovery, generally placing it in the "major-field" category, with an estimated reserve of 100,000,000 bbl. *(The Oil and Gas Journal, June 25, page 153).*

Citronelle produces from both the upper and lower Rodessa sands. As of August 16, it had 34 producers, including 11 dually completed wells. But the total is climbing almost weekly *(The Oil and Gas Journal, September 3, page 68).*

Only three wells had been completed in the field by the end of 1955. During the first half of this year, Citronelle produced more than 471,000 bbl. of oil. By midyear, 23 wells there were producing more than 5,000 bbl. daily, far surpassing the combined output of the 116 producers in Alabama's three other oil fields.

Aging "Black Dog" Finally Dies

WASHINGTON.—The long-contested issue of using gas as boiler fuel at Northern Power Co.'s Black Dog generating station has been ended by a Federal Power Commission refusal to review its June 30 order.

The order permitted Northern Natural Gas Co. to sell gas to Northern Power. It reversed an earlier decision, which was based on conservation, the unhealthy conditions of the coal industry, and low prices which allegedly would throw a burden on other customers *(The Oil and Gas Journal, July 9, page 63).*

The review was asked by coal interests, partly on technical grounds. It was charged that the case was not decided on the record, but on the basis of a conclusion reached in another proceeding.

The FPC held the contention to be without merit. It asserted it had relied on the record and referred to it frequently in reaching its decision.

Coal-industry spokesmen also argued that the commission originally found that Northern is faced with a gas-supply problem. But the FPC said this was merely the examiner's view and that it was never adopted by a majority of the commission members.

A major point of contention in the original arguments centered on the issue of "inferior use." Coal interests asserted that gas should be used only where coal is not suitable as a fuel.

Pipeline BRIEFS

EDMONTON. — Peace River Oil Pipe Line Co., Ltd., has completed burying and coating work on the 12 and 16-in. line from Valleyview, Alta., to the Trans-Mountain pumping station at Edson, Alta. The 106-mile line was built by Banister Construction, Ltd., at a cost of $7,500,000. The line has been in operation since April. Some clean-up work is still to be done.

DENVER. — Handridge Oil Co., Denver, owner of Plains Pipe Line Co., has merged with United Dye & Chemical Corp., New York, in a share-for-share stock exchange. Plains Pipe Line operates a 38,000-bbl. daily crude line in Wyoming.

Handridge bought the 100-mile line a year ago from Franklin County Coal Co., Newcastle, Wyo., a holding of the Murchison interests.

DAGGETT, Calif.—Construction has started on a 34-mile natural-gas pipeline which will connect Permanente Cement Co.'s new plant in Lucerne Valley with Pacific Gas & Electric Co.'s superinch line east of Daggett. The $800,000 project will consist of 22.7 miles of 10-in. line and 11.3 miles of 8-in. line. It is being built by a joint venture firm of Engineers Limited Pipeline Construction Co. and Alex Robertson. Completion is scheduled for late this year.

Also for Pipeliners . . .

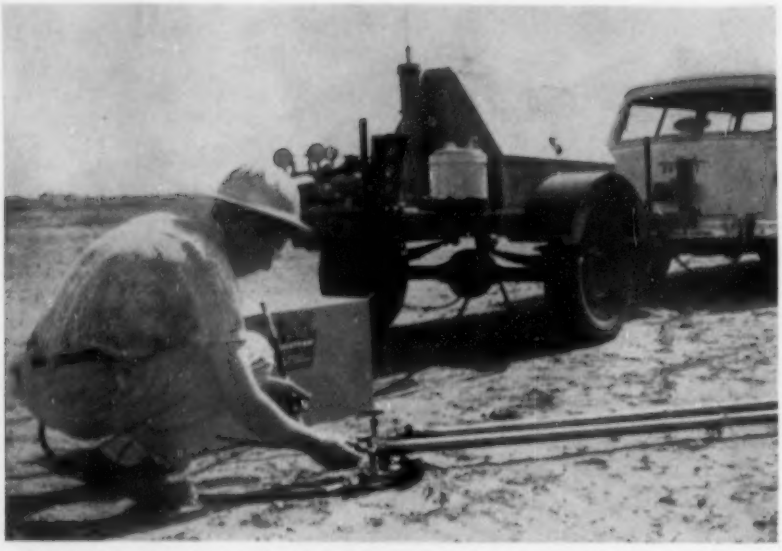
Magnolia unveils expansion plans for Midland-Beaumont L.P.G. line converted from crude service (P. 82) . . . California refiners and Rocky Mountain producers may build major crude line from Four Corners area to California (P. 83) . . . And El Paso Natural's first gas line is being reconditioned (P. 84) . . . Shell plans to expand West Texas and Montana crude lines (P. 90) . . . Tennessee Gas' plans to import Canadian gas for sale through the Midwest will be argued before FPC starting this week (P. 91) . . .

Plus these features:

Design formulas to eliminate pulsation troubles with positive-displacement pumps (P. 120) . . . And a new graph for solving problems in gas-flow measurements and pressure-drop calculations (P. 157).

NEXT WEEK

The Journal's thirtieth Annual Pipeline Number, a complete package of articles covering line and station design, construction practices, remote-control facilities, and system operation.



ENGINEER LOADS INJECTOR with rubber balls which make possible more complete treatment of wells with zones of varying permeability.

Fracture Aid Unveiled

● Use of rubber balls to seal perforations in selective well treatments aimed at reducing costs and saving time

MIDLAND.—Little rubber balls, ⅞ in. in diameter, are the key to a new fracturing and acidizing control method aimed at more complete treatment of the pay zone.

The new technique was developed by Western Co., an oil-well servicing firm headquartered here. It temporarily seals the section which opened up first and diverts the treating fluid into tighter sections which would not be broken down in an ordinary single-stage treatment.

The company claims the rubber balls, called Perforation Ball Sealers, are the answer to a long-standing problem: How to treat selectively multizone wells without using complex and costly down-hole tools such as packers or bridge plugs. The new control method is aimed at completing multitreatment operations in a single stage at a saving of both time and money.

How it works . . . The rubber balls act like free-floating valves.

Injected into the casing, the sealers are pulled to perforations taking fluid just as a plug is sucked into a bathtub drain. This temporarily seals the most permeable section which was fractured first. Fluid is then diverted to the tighter sections and more complete fracturing results.

When the treatment has been completed, the rubber balls drop to the bottom of the hole. They may be left there or recovered with a bailer.

A CLOSE-UP shows the ⅞-in. balls used to divert treating fluid to tight zones by sealing off other perforations.

Western says multistage operations can be completed in a single setup regardless of the number of zones to be treated, the length of the zone, or the distance between perforated intervals.

The sealers are designed to reduce the need for stage treatments, multiple use of down-hole tools which must be retrieved or drilled out, and chemical plugging agents. Their goal is similar to plugging agents such as naphthalene pellets. The pellets enter the fracture itself, however, and are flushed out later when a well is placed on production.

Savings . . . Western cited one multistage fracture job in West Texas where cost to the operator using normal methods was $6,400.

A similar job a few locations away, involving roughly the same amount of effective pay but using the ball sealers, cost $1,200 less, Western said.

The company's base charge is $150 plus $50 for the first 100 balls and 35 cents per ball thereafter. The company compares it to use of a bridging plug costing $600 to $700 in place, plus drilling-out costs. It claims a savings in pumping-equipment rentals of up to two-thirds by treating a whole section on one setup.

The number of rubber balls required is roughly equal to the number of perforations.

The technique is based on an idea of Charles Simmons, regional manager for Western in North Texas, Oklahoma, and Kansas. It was developed by company engineers. Western has performed 50 jobs using the Perforation Ball Sealers. The service is offered in West Texas, the Texas Panhandle, New Mexico, Oklahoma, and southwestern Kansas.

Oil Pays High Tax

One-tenth of Government's excise tax comes from oil

WASHINGTON.—Over one-tenth of the federal Government's total excise tax revenue comes from the four levies on oil.

Collections from this source during the fiscal year ended June 30 amounted to $1,165,126,000. The total from all excises was $10,004,195,000, according to the Internal Revenue Service.

Receipts from oil in the preceding fiscal year totaled $1,080,646,000 out of $9,210,582,000 from all sources.

The take from oil is topped only by that from distilled spirits, cigarettes, and automobiles. The four groups account for approximately 60 per cent of all excise revenues.

Taxes paid by gasoline, prior to the increase for the road-building program, totaled $1,030,397,000 in fiscal 1956. The tab was $954,678,000 the preceding year. Lubricating-oil taxes, long on the downgrade, reversed that trend to provide $75,584,000, up from $69,818,000. Pipeline transportation brought in $35,681,000 compared to the previous $33,458,000, and the tax on diesel fuel returned $24,464,000 against $22,692,000.

Dresser tries another tack . . .

. . . New Turbodrill Deal Made

WASHINGTON.—Dresser Industries, Inc., was reported by informed sources here last week to have negotiated a new agreement with Russia to bring Russian-designed turbodrills into this country.

A previous agreement between the two parties was rejected by the Commerce Department earlier this year because Dresser, in return for the drills, was committed to give certain oil technology to Russia.

The new deal, Washington sources say, does not commit Dresser to turn over this technical data deemed strategic by the Government.

Russia is to ship 40 turbodrills to Dresser in the United States, together with Russian technicians to demonstrate them. The 40 drills reportedly would include several different sizes of three main types. There would be a "regular" type for hard-rock drilling, a "sectional" type for drilling in softer formations, and a turbo core drill.

State Department snag . . . It isn't known yet what Dresser would give in exchange under the new deal.

It's hung up in the U. S. State Department, which must approve issuance of visas to any Russian technicians who would enter the country. The department so far has appeared to be in no hurry to act on the matter.

Meanwhile, a statement here last week by Urban Niblo, Dresser representative in Washington, tended to confuse the issue.

Niblo said that Dresser plans to market its own turbodrill in 1957. This is contrary to previous company declarations.

Dresser's plans . . . Dresser has indicated previously that the first turbodrills it distributes in this country will be either of French or Russian design. It plans to utilize the long experience of these countries with the drill rather than start from scratch to develop one of its own.

The company indicated it might improve on the French or Russian designs later on by employing methods of manufacture or materials not available in those countries. The Russians claim much faster penetration rates and cheaper drilling with the bit being turned by a mud-powered turbine rather than rotating drill pipe. Experiments in this country have failed to develop a turbodrill which would stand up.

When, and if Dresser does market the tools, they likely will be manufactured in Dallas, the company's headquarters city. In its official announcement late last month of the purchase of Guiberson Corp., also of Dallas, Dresser noted that Guiberson facilities were "ideally suited" to manufacture the drill.

Progress in the offshore stalemate . . .

Louisiana Approves Compromise

BATON ROUGE. — The Louisiana Mineral Board last week approved general terms of a compromise proposal under which drilling might be resumed in the disputed area offshore.

But the board's action left unsettled the major issues involved in the dispute between the state and federal Government. Industry observers predicted that at least 10 days or 2 weeks will be required to iron out the controversy.

Industry proposals approved by the mineral board would provide for impounding of lease and royalty payments claimed by both the state and the U. S. Department of Interior.

They also would allow resumption of leasing between 3 miles and 3 leagues offshore in areas where it can be shown that wells on adjoining leases were draining reserves from the disputed area. Leasing would be deferred for 1 year between the 3-league line and the southern limits of the area over which the state claims jurisdiction.

Both leasing and new drilling within the disputed region were barred by the U. S. Supreme Court in June pending settlement of the boundary question. However, the court provided that operations might be resumed under terms of a mutual agreement between the state and the Interior Department.

Industry spokesmen said that a compromise still must be reached before the two government agencies can agree on the two basic issues involved—leasing and jurisdiction. They expressed hope that the latest proposal might clear the way for such an agreement and that negotiations might resume between the state and federal Government within a week.

Industry BRIEFS

HOUSTON.—Construction will start soon on a large heat treating plant at the Houston mill of Sheffield Steel, a division of Armco Steel Corp. Company officials said the addition will make the Houston plant a major source of specialized steels used in manufacture of oil-well drill collars; stud bolts for oil-field equipment, refineries, and chemical plants; high-pressure tanks; and other equipment using high-strength alloy steel.

REGINA. — Saskatchewan now has more than 2,000 producing oil wells. The province passed that mark about the middle of August when 18 wells were completed in a week. They raised the total to 2,004. At that time, there also were 142 gas wells either producing or capable of producing.

FORT WORTH. — Ambassador Oil Corp., Fort Worth, has sold 11 gas-distillate wells in the Bethany-Carthage area of Panola County, East Texas, for $3,000,000 to an undisclosed buyer. The purchasing company, which is withholding its identity temporarily, will take over operation of the wells October 1. Ambassador retains all deep mineral rights and reversionary interest in the profits, according to F. Kirk Johnson, president.

NEW YORK.—The American Petroleum Institute has revised its manual, "Safe Practices in Well-Pulling Operations," to cover problems brought on by new equipment and deeper wells. It is available through A.P.I. headquarters here.

SEATTLE.—Pacific Northwest Pipe-Line Corp. is spending $6,294,000 more than originally planned for its big pipeline from the San Juan basin to Washington State. The firm said the $160,000,000 initial estimate was increased by high costs of right-of-way and materials and other factors.

WICHITA. — Musgrove Petroleum Corp. has been sold to American Hide & Leather Co. of Boston and Lowell, Mass., in a stock-exchange deal. Musgrove will become a subsidiary, with no change in management.

The oil firm has 90 wells in Kansas, producing about 2,000 bbl. daily. It also operates as a drilling contractor. American Hide, which soon will change its name to General American Industries, has been diversifying its interests through new purchases since last fall.

Compact Issue Dodged

Brownell declines to issue ruling on antitrust status of interstate oil body; claims more information needed

WASHINGTON.—Attorney General Brownell declined to take a position last week on whether activities of states belonging to the Interstate Oil Compact are in violation of the antitrust laws.

Such a finding, Brownell said, could be made only after an intensive investigation of the entire oil industry.

Congressional approval for extension of the Compact last year carried an order for an annual report from the Justice Department as to whether the activities of member states were in line with the antitrust section (Article V).

Brownell interpreted the order as a mandate to make an all-out investigation of the practices and organization of the oil industry.

That view prompted him to ask for some $750,000 this year for the study. Congress didn't agree that such an extensive undertaking was necessary and cut the figure to $25,000.

First annual report . . . The attorney general's first annual report was largely devoted to an explanation of his views and a lot of interesting background. But its most important section revealed why Brownell refused to pass on the legality of what the states are doing under the Compact.

"The ultimate purpose for which the report requirement was enacted seems clear: To provide Congress with an informed judgment by the attorney general on the competitive effects of the system by which oil production is regulated," Brownell commented.

"However, that purpose cannot be ascertained by direct reading of the statute alone, for while it clearly directs the filing of reports annually for 4 years, it is not altogether clear in indicating the precise subject matter of the reports."

The reference to "activities of the states," Brownell said, raises important questions of federal-state relationship.

Constitutional problems . . . For him to "review the purposes of the state regulatory agencies and sit in judgment upon the motives and ends which they sought to attain might well involve constitutional problems," he pointed out.

But the extent to which "the unique and complex system" governing domestic oil production affects interstate trade and commerce is properly a subject of federal legislative concern, he added.

In addition, the functioning of the state agencies depends in large part upon the action of federal agencies under federal law, he said.

What Congress really wants, Brownell concluded, is:

. . . An examination of the petroleum industry to determine if it evidences the existence of anticompetitive practices, including monopolization and price stabilization.

. . . A determination of whether any such practices result from this regulatory system.

The heavy burden such an inquiry would place on the Justice Department led the department to recommend that the report requirement be dropped, Brownell disclosed.

Due to the lack of time and money, the attorney general explained, his first report is confined to an evaluation of published material, matter in the department's files, and information furnished by the Interstate Oil Compact commission.

It is intended only as a starting point from which further inquiry may be carried out, he said.

More information needed . . . "It should be expressly noted that neither this summary in itself nor the examination of the published materials from which it is drawn provides an adequate basis from which the conclusions required by statute can be drawn," Brownell emphasized.

"Any such conclusions necessitate a more comprehensive basis of information. This can only be derived from direct investigation as future budget conditions permit."

American Petrofina Vote Due

DALLAS.—Stockholders of Panhandle Oil Corp. will vote September 27 on a merger with American Petrofina, Inc., part of the Belgian Petrofina Group which plans to establish a major integrated company in the United States.

Petrofina gained control of the Texas company in April by a $6,750,000 deal. It purchased 600,000 shares of Panhandle stock at $11.25 per share and took option for another 257,030 shares. Petrofina later exercised the option for 50,000 shares, selling them to two investment firms. It does not plan to exercise its option on the remaining 207,030 shares.

Under the proposed merger, Panhandle stockholders will receive 1.3 shares of American Petrofina Class A common stock for each share of Panhandle common. The surviving company will own all the oil properties and assets now owned by Panhandle and in addition will have about $28 million in cash.

The companies . . . Panhandle is a comparatively small integrated operating oil company. It has a 7,500-bbl. daily refinery in Wichita Falls, Tex., plus 250 marketing outlets in Texas, Oklahoma, and New Mexico. Its oil production totals about 3,500 bbl. daily. Net oil and gas reserves are 15,000,000 bbl. of oil and 95,000,000 M.c.f. of proved and developed gas reserves.

American Petrofina is a new company controlled by Belgian Petrofina. Its assets prior to the proposed merger consist of its investment in Panhandle stock and about $13 million in cash.

Roger Gilbert, president of Panhandle, in a prospectus to stockholders, reported the merger if approved will be completed about October 1. He will be retained as financial vice president of the surviving company at an annual salary of $45,000.

After the merger, American Petrofina plans to acquire other oil properties, expand development and exploration activities, and build up the refining and marketing phases of the business in the United States, Gilbert said in the prospectus.

Directors . . . Harry A. Jackson, former Tidewater Oil Co. executive, who became president of American Petrofina this summer, will retain his job at a salary of $75,000 annually.

Directors in addition to Jackson and Gilbert will be Alfredo F. Campo, president of Canadian Petrofina; W. David Heath Eves, executive vice president of American Petrofina; Francis Kernan, investment banker; Laurent B. Wolters, managing director of Belgian Petrofina; J. Howard Marshall, vice president of Signal Oil & Gas Co.; Gustav P. Fleck, president of Amsterdam Overseas Corp.; and Walter C. Teagle, Jr., director of Teagle Foundation.

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Shell Boosts Pipelines

Twin projects will add stations to step up capacities of Rancho system in Texas, Butte line in Rocky Mountains

HOUSTON.—Shell Pipe Line Corp. has announced plans to increase the capacity of two pipelines moving crude oil from fields in West Texas and Montana.

Booster stations will be constructed on the Rancho Pipe Line system about 30 miles west of Houston and on the Butte Pipe Line near Alzada, Mont.

The new facilities are scheduled to go into operation late this year or early next. They will increase capacity of Rancho 25,000 bbl. daily and Butte 12,000 bbl. daily. The Rancho line has been operating at capacity into Houston.

Butte, although not previously utilizing all its capacity, is being prepared for future development of areas it serves.

Remote controls . . . The Rancho installation, to be known as the Katy station, will be the first remotely controlled unit on the 455-mile line which moves crude from the Permian basin to the Houston-Texas City refining center. Located 7 miles south of Katy, Tex., the station will be operated by controls at Garfield station 109 miles to the west.

Shell officials said the new station will require only routine checks by personnel. Two 2,000-hp. motor-driven centrifugal pumps will be installed outdoors. The only building on the grounds will be devoted to switch gear, workshop, storage room, and communications equipment.

Plans call for the unit to go into service on or about January 1, although completion is not scheduled until March 1.

The Katy station will be the fourth on the 24-in. line. It will boost capacity of the carrier from the present 232,000 bbl. daily to 257,000 bbl. Shell officials pointed out that the capacity could be increased to 360,000 bbl. per day through erection of four additional stations which are still in the planning stage.

Automatic flow . . . The new station on the Butte line will have automatic flow controls and will include two 500-hp. motor-driven centrifugal pumps, one of which will be on standby service.

Plans call for placing the unit in operation by December if possible.

It will be located about halfway between Baker and Osage stations in Wyoming on the 16-in. segment of the Butte system.

The line ranges from 10 to 16 in. in diameter and extends from Poplar, Mont., to a point near Fort Laramie, Wyo. At the southern end it feeds into other lines transporting crude eastward to Wood River and other refining centers.

With installation of the new station, capacity of the Butte line will be increased from the present 37,000 bbl. per day to 49,000 bbl. By adding other units to the Alzada and Osage stations, the flow could be boosted to 70,000 bbl. per day.

Shell is part owner and operator of both the Butte and Rancho pipelines.

Plants Mushrooming

Four refineries are building or planned for Northwest

EVERETT, Wash.—Four refineries, one under way and three in the planning stage, will boost Pacific Northwest refinery runs to more than 185,000 bbl. daily within the next 2 years.

Standard Oil Co. of California is the latest to enter the Washington refining picture. It has announced a 60,000-bbl. plant due to get under construction near here late next year *(The Oil and Gas Journal, July 30, page 1).*

Standard's proposed refinery, to cost an estimated $75,000,000, will be built on a 2,000-acre site. It will employ 600 workers. Target date for completion is sometime in 1960.

The Texas Co. recently revealed plans to build a 30,000-bbl. refinery neighboring Shell Oil Co.'s 50,000-bbl. facility at Anacortes. U. S. Oil & Refining Co. is building a 10,000-bbl. plant outside Tacoma, and Straits Refining Co. has announced plans for a similar one on Puget Sound.

Rounding out the Northwest refining picture is General Petroleum Corp.'s 35,000-bbl. refinery at Ferndale.

Sinclair Plans Atomic Lab

HARVEY, Ill.—A special laboratory capable of making the most powerful radiation studies ever undertaken in industry is being built at the Sinclair Research Laboratories, Inc., here.

Sinclair has a special nuclear material license permitting it to receive and process up to 800 grams of U-235 contained in irradiated or spent fuel elements from the materials-testing reactor of the Atomic Energy Commission near Idaho Falls, Idaho.

This will give Sinclair the most powerful source of gamma ray radiation ever made available to a private industrial research center. The license is believed to be the first issued to an industrial corporation to use spent atomic fuel elements for gamma radiation studies. They will have a curie strength five or six times greater than any now used in industrial research.

The new hot lab is due for completion early next year. Sinclair will use it to study radiation effects on such processes as cracking, hydrocracking, hydrogenation, and isomerization.

Plants Police Flaring

New twist applied to old problem in Jameson field

AUSTIN.—The Texas Railroad Commission has taken a new tack in its fight to eliminate gas flaring in Texas.

It is putting part of the enforcement responsibility on the backs of the natural-gasoline plant operators in one problem field, the big Jameson (Strawn) reservoir in Coke County, West Texas.

The commission indicated it was thinking of doing this in a hearing earlier this month *(The Oil and Gas Journal, August 27, page 73).*

Jameson plant operators have been ordered not to accept more gas from each lease than the legal gas limits for all wells on that lease. Producers were ordered to limit casing-head production from each well to its gas limit.

Any well exceeding its gas limit substantially will be shut in.

The commission, in writing the order, said that far too much gas is being flared in Jameson and that gas-oil ratio tests have not proved an effective check.

How it works . . . At first glance it might appear that the new Jameson rule would result in more, rather than less, flaring since a producer whose market was cut off might be tempted to flare his illegal gas production.

The plant, however, must notify the commission when it has shut off a well after receiving its legal limit. Members of the commission's engineering staff will keep a close watch on such wells. And, as one staff member put it, "It will be a dark day for any operator caught flaring under such circumstances."

The commission has authority to levy fines or shut off an offender's well for an indefinite period.

Pipeline Showdown Approaches

WASHINGTON.—"Recent significant developments" in plans for the Trans-Canada pipeline project will be laid before the Federal Power Commission this week.

The information will be offered by Tennessee Gas Transmission Co. and its affiliate, Midwestern Gas Transmission Co., in answer to motions to dismiss their applications to import and export natural gas.

The motions were filed by a number of interests, including Natural Gas Pipeline Co. of America, Texas Illinois Natural Gas Pipeline Co., and Northern Natural Gas Co., whose markets Midwestern would invade. Opposition also came from coal and railroad groups. Motions will be argued orally before Examiner Francis L. Hall September 13.

Midwestern plans . . . Midwestern plans to build a 1,112-mile line from Portland, Tenn., to Emerson, Man., to serve what it calls "long-neglected" natural-gas markets in Minnesota, Wisconsin, Illinois, Indiana, Kentucky, and Tennessee.

Midwestern would buy 204,000,000 cu. ft. of gas daily from Trans-Canada Pipe Lines, Ltd., at Emerson on the Canadian border and a like amount from T.G.T. at Portland. T.G.T. also proposes to sell up to 86,755,000 cu. ft. daily to Trans-Canada at Niagara Falls, to develop Toronto-Montreal markets pending extension of the Trans-Canada line to eastern Canada. *(The Oil and Gas Journal, October 17, 1955, page 90).*

The projects were the subject of hearings before an FPC examiner from February 14 until April 19. Since May a number of motions to dismiss were filed.

Opposition . . . Northern Natural opposed the Midwestern project as being "uneconomic, lacking markets, revenues, and financing." The company asserted it was based on the principle of "forcible invasion of the market territories of other pipeline companies."

Other pipelines objected to the "raiding tactics" by which Midwestern lined up Chicago industrial markets which they now serve. Peoples Gas Light & Coke Co. said loss of these markets would be harmful to its residential customers.

Midwestern, in its application, declared that Midwest pipeline companies had fallen down on the job of supplying their customers. The company has contracted to sell 145 million cubic feet of gas daily to steel mills in the South Chicago area at 7 cents per M.c.f. below the wholesale price offered by other pipelines.

Effect on Trans-Canada . . . The FPC decision will have an important effect on Trans-Canada, which is now building the 574-mile western segment of its proposed 2,250-mile line.

Trans-Canada's claim of firm contracts for 600,000,000 cu. ft. daily in the fifth full year of operating its system includes 200,000,000 cu. ft. with Midwestern. The Midwestern-T.G.T. project not only is Trans-Canada's biggest immediate customer, but also is the key to developing eastern markets.

Split Widens On Third Grade

NEW YORK.—The split among major gasoline marketers whether to add a third-grade superpremium widened last week.

Cities Service Oil Co. announced it is adding a third grade of 100-plus-octane to its line. Standard Oil Co. (Ind.) revealed it is standing pat on its steadily improved premium and regular.

Cities Service expects to have the new fuel available by early October at service stations in 14 selected cities on the East Coast and in the South. Distribution points will be Boston, Providence, New York, Newark, Trenton, Philadelphia, Baltimore, Washington, Norfolk, Newport News, Jacksonville, Tampa, Miami, Shreveport, and Lake Charles.

Production of the third grade already has started and addition of the third pumps will begin immediately.

Cities Service in addition to the superpremium is stepping up quality of its premium grade. This Super 5-D will incorporate all the features of the present premium with some higher octane rating. The regular-priced grade, called Cities Service Milemaster, will round out the line.

Indiana Standard Chairman Robert E. Wilson and President Frank O. Prior said their company's decision was based on study and research. Surveys show no need for adding one or more grades to the two gasolines now marketed in 44 states, they said.

The Indiana Standard executives stated their premium will meet requirements of the most modern cars. They added their refineries were in a position to make further octane improvements for any higher compression engines planned by the motor industry.

Oil Studies On Tap

House members plan trips to several foreign fields

WASHINGTON.—The House commerce committee, which made few investigations this year and none involving oil, is planning to look into a number of matters after the November elections.

Its studies may call for subcommittee trips to foreign areas for a first-hand view of the oil and other situations in which the committee is interested. Some of the committee would like to go to the Canadian oil fields. Others think it is time for a new look at Latin American operations. Some think the Middle East is ripe for new study.

A number of oil problems are expected to come up for congressional action next session. Topping the list is the import question. Failure of Mobilization Director Arthur S. Flemming to come up with an answer to this problem acceptable to domestic producers is sure to spark a demand for congressional investigation.

The Middle East oil situation, now to the fore because of the Suez Canal crisis, is another matter the committee may want to go into. And, of course, any new effort to overturn Federal Power Commission regulation of independent gas producers would alert the committee.

Merger Agreement Reached

MIDLAND, Tex.—Directors of Wilshire Oil Co. of Texas, and Britalta Petroleum, Ltd., of Calgary, have reached an agreement whereby Britalta will acquire Wilshire through an exchange of stock.

Britalta now has 2,360,000 shares of common stock outstanding. It will issue about 1,500,000 more shares to acquire Wilshire. Value of this stock was not disclosed.

The deal is subject to approval of stockholders of both firms, to audit reports, properties examinations, and to a favorable tax ruling by the U. S. Bureau of Internal Revenue.

Wilshire, with headquarters here, produces oil and gas in Texas, New Mexico, and Wyoming. Britalta has operated only in Canada.

Imports Showdown Near

Flemming gives importers tart reminder as entire issue heads for basic government decisions in next few weeks

WASHINGTON.—Oil importers got a tart reminder last week. Lack of cooperation from a few is raising the threat of formal import controls on all.

A majority of importers are adjusting their schedules in an attempt to conform with the cabinet fuels committee formula for relating imports to domestic production. But refusal of others to go along is thwarting efforts of Mobilization Director Arthur S. Flemming to get 1956 imports in line with the 1954 ratio.

Flemming again laid the matter before the importers last week. He urged them to adjust fourth-quarter entries. He wants to bring imports as close to the formula as possible in the few months remaining in 1956.

Reports filed by the importing companies in July showed that third-quarter programs were being cut back only 33,000 bbl. daily instead of the 90,000 bbl. asked by Flemming June 26. His proposed cut was aimed at getting third-quarter imports of Middle East crude down to a point 4 per cent below actual entries in the first 6 months of the year.

Flemming's latest letter to the importers did not indicate what effect their attitude might have on either the cabinet committee or the domestic producers' upcoming fight for formal controls under the national security clause of the Reciprocal Trade Act.

What's ahead . . . The timetable for action on imports over the next few weeks, however, indicates final decisions may be made without any further effort to make voluntary controls work.

Big questions: Are current import levels too high, and if so, what should be done about them.

Here is the timetable as presently indicated by administration officials:

The cabinet committee will meet with its task force possibly late this week but more likely next week. They will review the situation as developed by the working group's new study.

The committee is to reach a finding shortly thereafter. It must decide whether the 1954 relationship between imports and domestic output is still valid, and whether imports now are too high under that or any modified formula it may draft.

A date for the hearing on the producers' application for forced controls will be set as soon as the cabinet committee acts. The hearing probably will be started before mid-October.

Flemming will announce his decision on the need for application of the national security clause as soon as a study of the testimony taken in the hearing is completed. This may come some time in November.

A finding by Flemming under the law, that he "has reason to believe" oil is being imported in such quantities as to threaten to impair the national security, would throw the matter into the hands of the President. If he agrees there is reason for such belief, he must direct an immediate investigation to determine the facts.

If this inquiry confirms that a threat to national security exists the President then must "adjust" imports to correct the situation.

Novel Rig Ordered

Shell plans to use first portable diesel electric

DENVER.—The industry's first portable diesel-electric drilling rig will be tested late this year in the Denver-Julesburg basin by Shell Oil Co.

It is a trailer-mounted electric rig powered by four diesel engines and capable of drilling to 7,000 ft. using 4½-in. drill pipe.

"Its portability appeals to us," a Shell production spokesman said, "but, of course, we'll have to try it out to determine its qualities."

The rig is scheduled for delivery this fall, probably in November.

Ordered from Jones & Laughlin Steel Corp., the unit is being manufactured by Ideco Division of Dresser Industries. Caterpillar Tractor Co. is supplying the four diesel engines for prime power and two others for auxiliary power. General Electric Co. is furnishing d.c. generators for the diesel engines, plus two electric motors for powering the draw works and mud pump.

Court Rebuffs Apco Again

WASHINGTON.—Attempts of Anderson-Prichard Oil Corp. to get court relief from the drilling ban in Louisiana's "twilight zone" offshore came to a full stop last week.

The U. S. Court of Appeals for the District of Columbia handed Apco its latest rebuff. It refused to overturn an earlier decision by District Judge Edward M. Curranto not to modify the Supreme Court order which has tied up offshore activities in Louisiana since June 26 *(The Oil and Gas Journal, September 3, page 77)*.

Since the company already had failed to get relief direct from the Supreme Court, it is not expected to make any further legal moves.

Apco holds leases from both the state and federal Government on an 8,875-acre tract. It contracted before the stop order to provide a location by July 24 for drilling a well. As a reuslt, Apco now is paying the contractor $4,400 a day as well as dual rentals.

Navy Changes Bid for Land

BAKERSFIELD, Calif.—The Navy has dropped its request for a jet gunnery and bombing range on the west side of oil-rich San Joaquin Valley. But it will seek other training areas within a "reasonable distance" of its huge air base at Lemoore, officials said.

Protests by operators, farmers, and property owners prompted withdrawal of the Navy bid for parts of western Kern County, eastern San Luis Obispo County, and southern Kings County *(The Oil and Gas Journal, August 27, page 77)*.

Lemoore is located in southern Kings County, 65 miles north of here. Nearest oil production to the base is at Riverdale, 10 miles north, and at Kettleman Hills, 20 miles southwest.

Martinez Plant Expanded

MARTINEZ, Calif.—New facilities are nearing completion at Shell Chemical Co.'s Martinez plant for increasing production of one product and beginning production of another.

The latest member of Shell's family of products is an unnamed fuel oil additive. It is a dispersant for sludge particles in fuel oils and diesel fuels. Shell reports the new additive has been very successful in cleaning sludge from the tanks of oil tankers. It coats minute water particles and insoluble contaminants effectively in fuel oils. Burners then can be used without fuel-line screens being plugged. Production is slated to start in early September.

The growing demand for Shell's ethel amyl ketone (EAK) prompted the company to start the third expansion of facilities manufacturing this product since it was placed on the market in August 1952.

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Latin Oil Plans Mapped

Argentina, Brazil are developing programs to boost crude positions; lacking are keys to success: Money, know-how

THE two largest nations in Latin America have ambitious programs to make themselves self-sufficient in oil, but neither is likely to make the grade in the very near future.

Argentina and Brazil are being compared to sprinters on a treadmill. Both are running hard to stay in the same place. Oil consumption is rising rapidly in both countries, but production is only inching upward.

The two countries are the major Latin American nations whose nationalistic policies still bar foreign capital. Both are extremely short in the two areas needed to develop an oil industry of the size each needs—capital and technical know-how.

These two vital shortages are compounded by an almost daily increase in the internal oil consumption in both countries. This means just one thing, an even further drain on foreign exchange in both Brazil and Argentina. Both countries are spending money to import crude and products when neither has enough cash to develop a healthy domestic oil industry.

Argentina's picture . . . Argentina's new president, Pedro Aramburu, last week took the first step in a move designed to attract American dollars—but not U. S. oil companies—to his country. He said the state-controlled oil agency, Yacimientos Petroliferos Fiscales, is now "autonomous."

Giving the green light to Y.P.F. to negotiate for foreign equipment and know-how—on credit terms—Aramburu predicted that the country will be able to furnish her own oil needs by 1959. The principal items involved in the program are:

. . . $75 million worth of drilling equipment.

. . . $95 million worth of pipelines from the Salta Province fields such as Campo Duran to Buenos Aires and San Lorenzo on the Parana River.

. . . $50 million worth of new refining capacity, both in new plants and expansion projects at existing refineries.

The hitch in all this is that even if Argentina is able to obtain credit commitments from manufacturers and builders in Europe and the United States, her problem won't be solved. Oil men are openly skeptical of the idea that the country can become self-sufficient by 1959. If she does, Argentina will have to triple her production in less than 3 years. During those 3 years, her oil consumption will continue to rise. It's rising now about as fast as any area of the world.

Imports . . . Argentina last year spent about $200 million of her precious foreign-exchange currency to buy crude and products to meet her needs. Her own production amounted to about 40 per cent of her domestic oil consumption.

Imports of crude and products by Argentina during the first 6 months of 1956 increased more than 14 per cent over similar imports last year. At the same time her domestic production rose a little more than 2 per cent.

The first half of 1956, Argentina produced an average of slightly more than 84,000 bbl. daily. During the same period she imported more than 153,000 bbl. daily.

If Argentina should double her production in 3 years, the resulting 170,000 bbl. daily would fall far short of her present consumption of nearly 240,000 bbl. daily. With her consumption gaining at an average rate of 10 per cent a year, Argentina will be falling even farther behind.

Brazil's outlook . . . While Argentina was thumping the drum to attract financing, Brazil was announcing a drilling program which calls for 1,454 new wells by the end of 1950.

Col. Januario Nunez, the new head of Petrobras, the government's oil monopoly, said last week the drilling program will cost $420 million. He estimated that Petrobras could furnish half the money from its share of import duties and the special tax on automobile licenses in Brazil. The remainder will have to come from general government revenues.

Today, Brazil produces only about 7,000 bbl. daily of the more than 170,000 bbl. daily which she consumes. The country faces much the same prospect as her neighbor, Argentina, in that consumption is rising by leaps and bounds and the program to supply oil needs internally is still being mapped.

The new Petrobras head divulged the country's drilling program before a committee of the Brazilian Chamber of Deputies. The committee is considering a bill to give Petrobras a monopoly on gasoline marketing. Col. Nunez said he wanted no part of it. He said he'd be happier if Petrobras was allowed merely to control the importation of oil as it does now.

Four American oil companies, subsidiaries of Standard Oil Co. (N.J.), Gulf Oil Corp., The Texas Co., and Atlantic Refining Co., market most of the gasoline sold in Brazil. The bill before the Chamber of Deputies would compel these companies to sell only to Petrobras which in turn would handle domestic marketing.

Col. Nunez told the government officials that locations for the more than 1,400 wells he plans to drill in the next 4 years will be based on the work now being done by 32 exploration crews in Brazil. He said another eight seismic crews will be added to the program before the end of this year.

Only 12 wildcat wells are expected to be drilled in the 1956 portion of the government's program.

Trinidad Sale Near

Colorado firm negotiates for island oil property

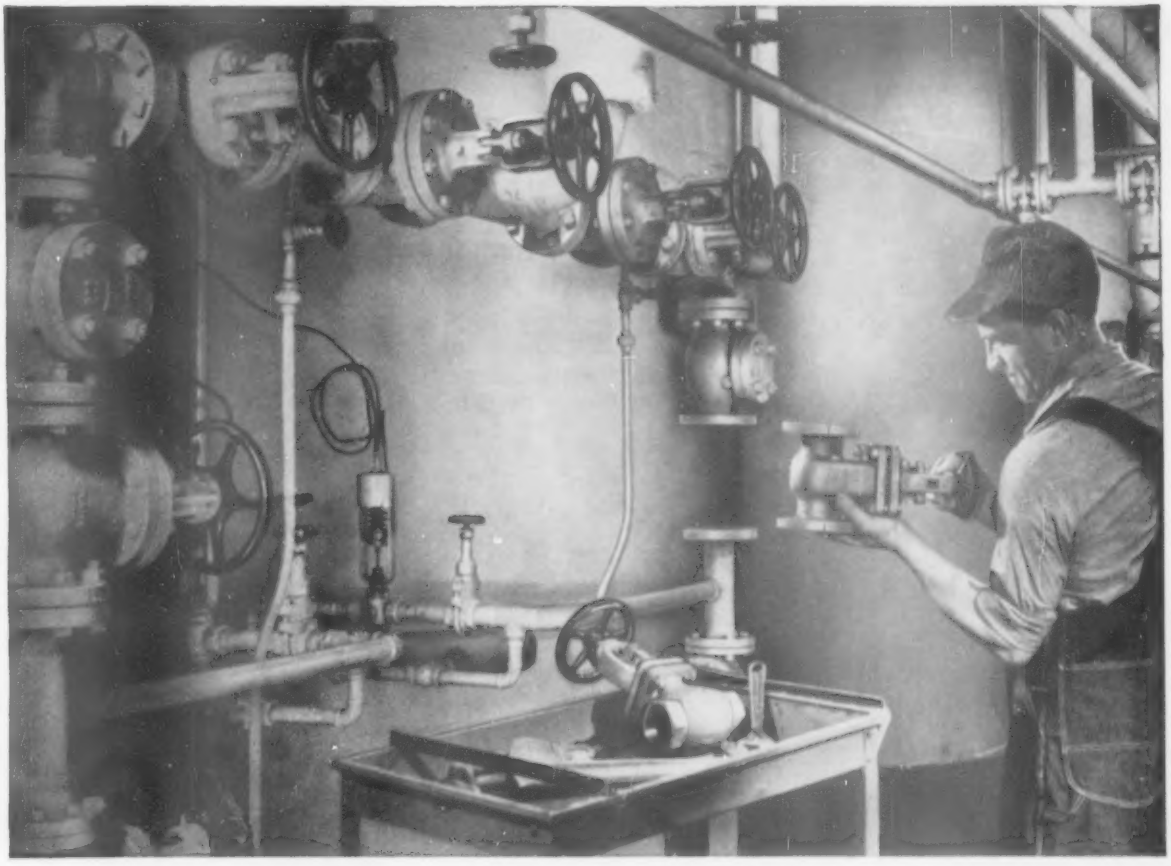
THE British and Trinidad governments soon may sit in on negotiations for the purchase of Trinidad Petroleum Development Co., Ltd., by Colorado Oil & Gas Corp.

Terms for the proposed purchase are not final. But talks have advanced to the point where the companies want to discuss the deal with the two governments, since both would have to approve the transaction.

Sale of Trinidad Petroleum would be the second Trinidad oil company to be purchased by a United States firm this year. Trinidad Oil Co., Ltd., recently was sold to The Texas Co. for $176,000,000.

Colorado Oil & Gas has crude and natural-gas production in the Rocky Mountains and Midwest. It is a subsidiary of Colorado Interstate Gas Co., operator of a big-inch natural-gas pipeline system in the Rocky Mountains.

What's involved . . . Trinidad Petroleum produces around 10,000 bbl. daily and has rights on about 73,800 acres in the southern part of the island. The company also has a license over about 350 sq. miles of offshore areas in the Gulf of Paria and off the south and west coasts.



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Globe and angle valves now feature a modified plug-type disc that combines the advantages of the easier seating of the narrow ball-to-flat seat and the high resistance of the wider plug-type disc to corrosion, erosion and cutting. In addition, these valves offer a new swivel disc-stem connection that seats the disc squarely every time. Minimum clearance eliminates vibration.

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Costa Rica Finds Oil

Union Oil of California adds Central America to world's producing list, prepares to test adjoining Panama block

UNION OIL CO.'S persistent wildcatting in Costa Rica has finally paid off with Central America's first oil discovery.

The strike is sure to bring a rush of applications for acreage which Union must turn back to the government now that production has been found. And the excitement it touched off has spread across the border into Panama where Union also has a concession which it plans to drill immediately.

Union hit on its fifth try in Costa Rica at its 2 Cocoles, located 16 miles inland from the Caribbean Coast in the vicinity of Puerto Viejo less than a mile from the Panama border.

The well flowed clean 46°-gravity crude at rates varying from 200 to 500 bbl. daily on the first formation test from around 4,950 ft. On the second test the flow rate climbed to 1,000 bbl. daily with high pressure. Union was running casing to complete the well last week.

A. C. Rubel, president of the company, hailed the 2 Cocoles as "a discovery of tremendous importance."

It was drilled on a 3,500,000-acre concession held by Union under contract with the Costa Rican Government. Success came after Union found promising shows earlier this year at 5,400 and 6,400 ft. at the 1 Cocoles nearby *(The Oil and Gas Journal, March 16, page 138)*.

Tests from 114 ft. of oil-saturated limestone at 5,450 ft. had raised hopes that the 1 Cocoles would become Central America's first producer. Salt water was encountered when the hole was taken to 6,233 ft. and 8⅝-in. casing was run to protect the upper zone. Drill-stem tests also indicated possible commercial oil of "excellent quality" in the deeper zone, which was reported to have unusually high gas pressure.

The well was abandoned, however, and the rig skidded a short distance in the dense jungle where the 2 Cocoles was spudded in. The discovery was drilled by Loffland Brothers Co.

Union-government contract . . . The agreement which Union negotiated with Costa Rica calls for the company to return all but 370,650 acres of its 3,500,000-acre exploration concession to the government after commercial oil is found.

Union's license covers areas in the northwest as well as the southeast, where the discovery was made.

A special contract was necessary because Costa Rica had no petroleum law at the time. But the encouraging shows in the 1 Cocoles caused the Legislative Assembly to start drafting a code covering the granting of exploration and exploitation concessions.

It was understood the contract with Union provided for 80 per cent ownership by the company and 20 per cent by the government. It cannot be expected to be a basis for a general code, however.

Legislators have been studying the laws of Guatemala and Venezuela as a guide in writing the new law.

Panama test . . . Loffland Brothers has moved a small spudder into Panama to start a wildcat on the 350,000-acre tract which adjoins Union's Costa Rican block.

Union reportedly was committed to start drilling by November, but announced operations would begin this month. The well will be taken to 1,500 ft. with the spudder and then a rotary rig will be moved in.

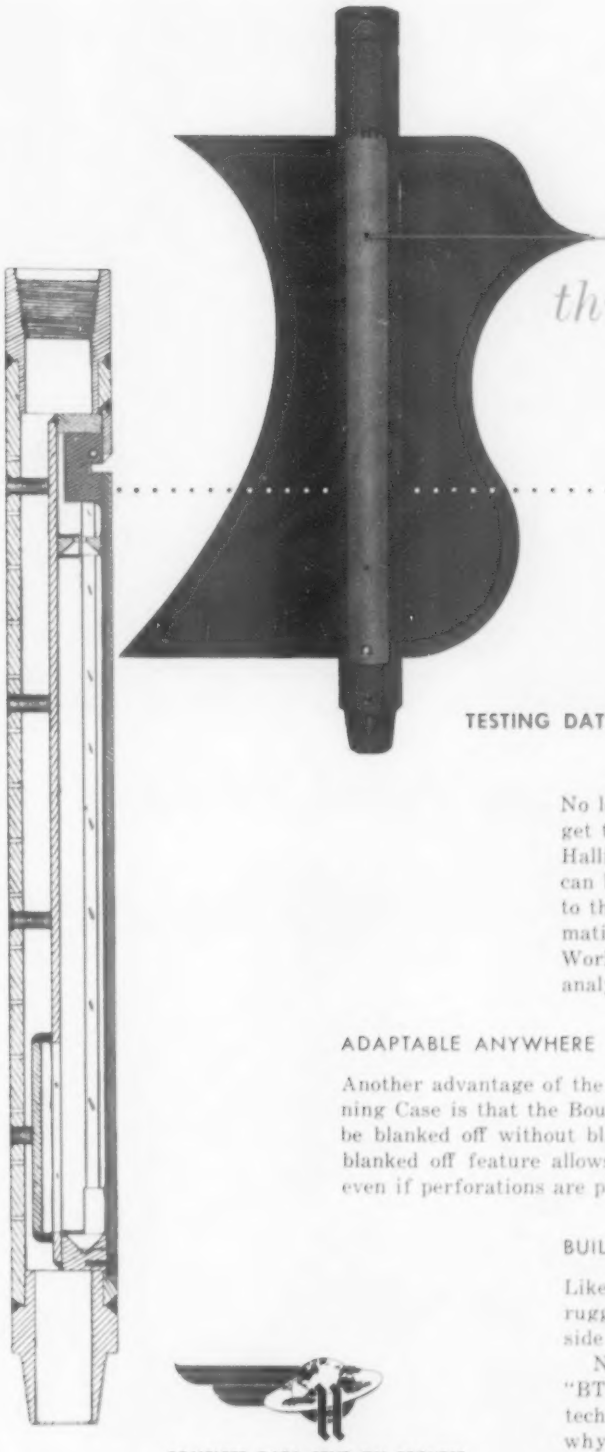
Other operators . . . It will provide a new impetus to Panamanian exploration, which has just been resumed after a 7-year lapse.

International Oil & Metals Corp., Seattle, announced a wildcat for central Darien Province in southeastern Panama last month. The company, new to the oil industry, acquired 75 per cent interest in a 10,000,000-acre concession held by Cia. Petrolera del Golfo del Darien *(The Oil and Gas Journal, August 20, page 119)*.

Another oil newcomer, Consolidated American Industries, Inc., has scheduled a test to start about November 1 near San Blas on the Caribbean Coast about half way up the isthmus from the International acreage. The company received a 2,240,000-acre concession in June.

Exploration extending as far back as 20 years has been conducted by Sinclair Oil Corp., Cities Service Co., and Gulf Oil Corp. The only good show turned up was by Gulf at Garachine 120 miles southeast of Panama City near the Pacific Coast.

Sinclair Panama Oil Corp., owned by Sinclair and Cities Service, left Panama in 1949 after 3 years of exploratory work during which two dry holes were drilled. Sinclair earlier found some gas on Columbus Island off the Caribbean Coast. Cities Service drilled three dry holes to 3,500 ft. in the Darien area about 1928.



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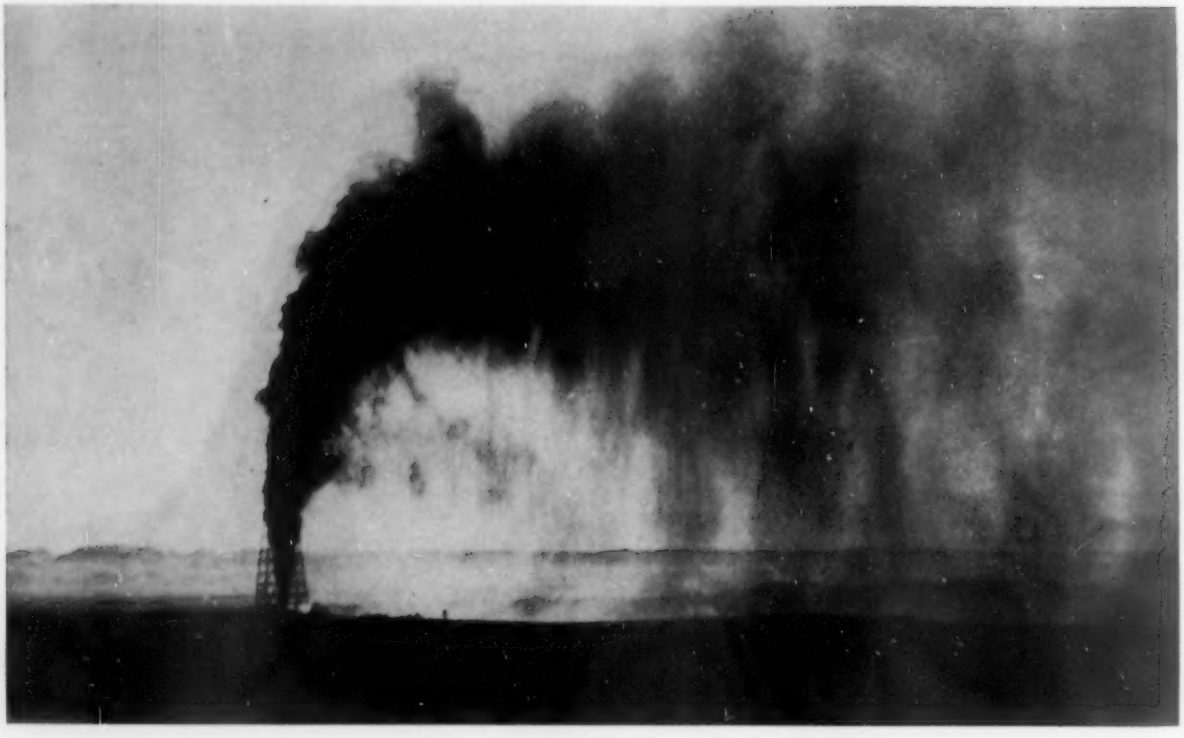


Flood of Oil Flows From Wild Well

IRAN'S rank, big discovery was still a wild wildcat late last week.

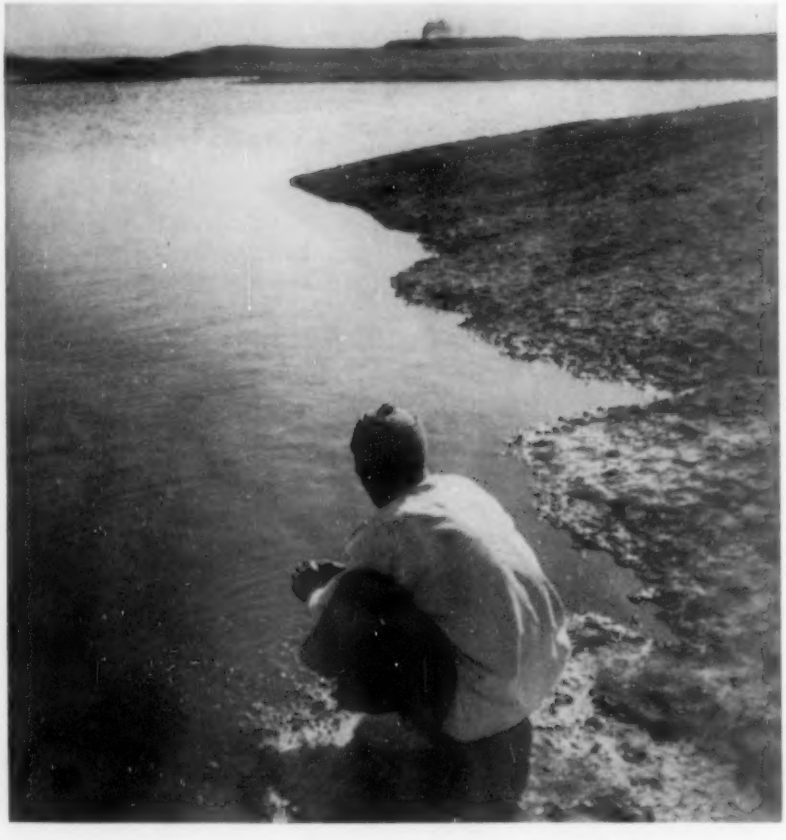
Engineers of National Iranian Oil Co. and the international consortium operating in Iran, together with Myron Kinley, Houston wild-well expert, were gathering equipment to try and cap the gusher.

The well, more than 200 miles from the nearest producing field, blew out 2 weeks ago. Its flow has been estimated all the way from 80,000 to 150,000 bbl. of crude daily, with a gas flow of 200,000,000 cu. ft.

These photographs would indicate the estimates aren't exaggerated. The rig is a National 100, with a conventional 136-ft. derrick. At right is a river of oil flowing from the wild well in the distant background.

The well is the first discovery outside the concession area in Iran operated by the international consortium of companies. It was drilled for N.I.O.C., the government oil company, by Drilling & Exploration Co. under contract.

The discovery is the fifth well drilled in the central plateau area for N.I.O.C. since 1949. All were drilled by Drillexco and two previous wells had oil shows. Both were lost by crushed casing, apparently from flowing salt strata. None reported anything like the most recent well.



For its Lake Maracaibo leases . . .

Venezuela Gets Fringe Benefits

WHEN Venezuela's President Marcos Perez Jimenez announced last January that his country was ready to entertain new bids for oil concessions, he warned that oil companies were going to have to give some "special advantages to the nation" if they got acreage.

It was becoming more and more apparent last week that the Venezuelan president meant just what he said.

In the first rash of successful bids, the companies offered $360 million in bonuses for nearly 315,000 acres of Lake Maracaibo concessions.

The fat bonuses had some of the bidders shaking their heads in dismay. But that isn't all.

Last week's Official Gazette indicated that some of those "special advantages" to Venezuela were included in bids. The government publication revealed:

. . . **A 25 per cent royalty** offer in addition to a bonus bid of $18,129,000 was made by Sun-Atlantic for the 10,000-hectare Block 1 in the lake.

In addition to the royalty and bonus, the two-company combine offered $500,000 as a gift to the government's welfare and education fund which is devoted to petroleum and allied fields, including the petrochemical industry.

. . . **A 15-year contract** to supply 2,118,840,000 cu. ft. of gas annually for general distribution and for the country's new petrochemical industry was offered by Cia. Shell de Venezuela. This was in addition to Shell's bid of $790 an acre for the 24,710 acres in Block 7 in the lake.

. . . **Aerial magnetometer** and scintillometer surveys of areas to be selected by the government were offered by Mene Grande Oil Co. in addition to bonus bids of $1,134 an acre for Lake Maracaibo tracts.

. . . **A bonus bid** of $983 an acre was made by Creole Petroleum Co. for the 24,710 acres in Block 5.

Neutral Zone Flow Stepped Up

A DRILLING and development program in the Neutral Zone apparently is paying off in stepped-up production.

The newest Middle East producing area to nudge its way into world markets increased its crude shipments to a record level in the first half of the year. Exports of 37,600 bbl. daily in June, the best month to date, brought the half-year average to 29,300 bbl. daily. This was a gain of 8,600 bbl. daily or nearly 42 per cent over the first 6 months last year.

Even greater production may be in the cards. Getty Oil Co., one of the Neutral Zone operators, in early summer shipped new equipment to the area and announced a drilling program aimed at increasing production to 100,000 bbl. daily by the end of the year *(The Oil and Gas Journal, May 28, page 102)*.

While the present level of exports is small, by Middle East standards, the Neutral Zone operation has held the interest of the oil industry as the first venture in the region by independent companies.

American Independent Oil Co. lifted 24,800 bbl. daily in June, bringing its 6-month average to 15,700 bbl. daily. Aminoil has a concession over Kuwait's one-half undivided interest in the tiny, wedge-shaped desert area.

Getty lifted 12,800 bbl. daily, compared with its half-year average of 13,600 bbl. daily. The company has a concession over Saudi Arabia's interest in the zone.

Japan took 12,100 bbl. daily from Aminoil in June, while 12,700 bbl. daily was sold in Italy. The company shipments on a half-year basis were: 1,300 bbl. daily to the United States, 6,000 bbl. daily to Italy, and 8,400 bbl. daily to Japan.

Getty in June shipped 7,300 bbl. daily to the United States, and 5,500 bbl. daily to France. Over the first half importers were: U. S., 6,000 bbl. daily; France, 5,300 bbl. daily; and Japan, 2,300 bbl. daily.

Wildcat Hits in Germany

West Germany's northernmost wildcat, 7 Schwedeneck near the Baltic Coast, has apparently tapped a commercial reservoir.

It yielded 63 bbl. daily of 25°-gravity crude on pump during production tests from about 5,000 ft. The well is located about 30 miles southeast of the Danish border and 11 miles east of Eckernfoerde. It was shut in and the rig is drilling an offset 1,000 ft. to the southeast.

Wintershall-DEA drilled the discovery to test the western flank of a big Jurassic syncline. Kiel, Ploen, and Boostedt fields to the south are on the same structure. They have a combined output of around 3,500 bbl. daily.

Spanish Job Slowed

Christmas completion set for defense products line

COMPLETION of the 485-mile military oil-products pipeline in Spain has been delayed by bad weather. Newest completion date for the line linking U. S. air bases in the country is now about Christmas.

The $30-million line of 8, 10, and 12-in. diameter pipe was started last October at Rota on Spain's Atlantic Coast. The United States maintains a naval base there. Since then, the project has moved southwestward across the Spanish peninsula to a point southwest of Madrid.

It is estimated that the line will reach the U. S. air base at Torrejon, 15 miles northeast of Madrid, by October 1. Three spreads are now at work. One is moving northeast toward Madrid, one working from Madrid north and east, and a third working southwest from a big U. S. bomber base at Zaragoza.

The pipeline will connect the Atlantic seaport of Rota with five American air bases and other military installations in Spain. The over-all program calls for building $300 million worth of air and naval bases in Spain under terms of military agreement with the United States.

Prime contractor for the entire program is Brown - Raymond - Walsh, a group made up of Brown & Root, Inc., Houston; Raymond Concrete Pile Co., New York; and Walsh Construction Co., Davenport, Iowa.

The pipeline itself is being built by Merritt-Chapman & Scott Corp., New York; Benson & Montin, Oklahoma City; and Agroman Empresa Construction, Madrid. About 130 American pipeliners are being used in laying the line along with Spanish laborers *(The Oil and Gas Journal, May 30, 1955, page 67, and June 27, 1955, page 67)*.

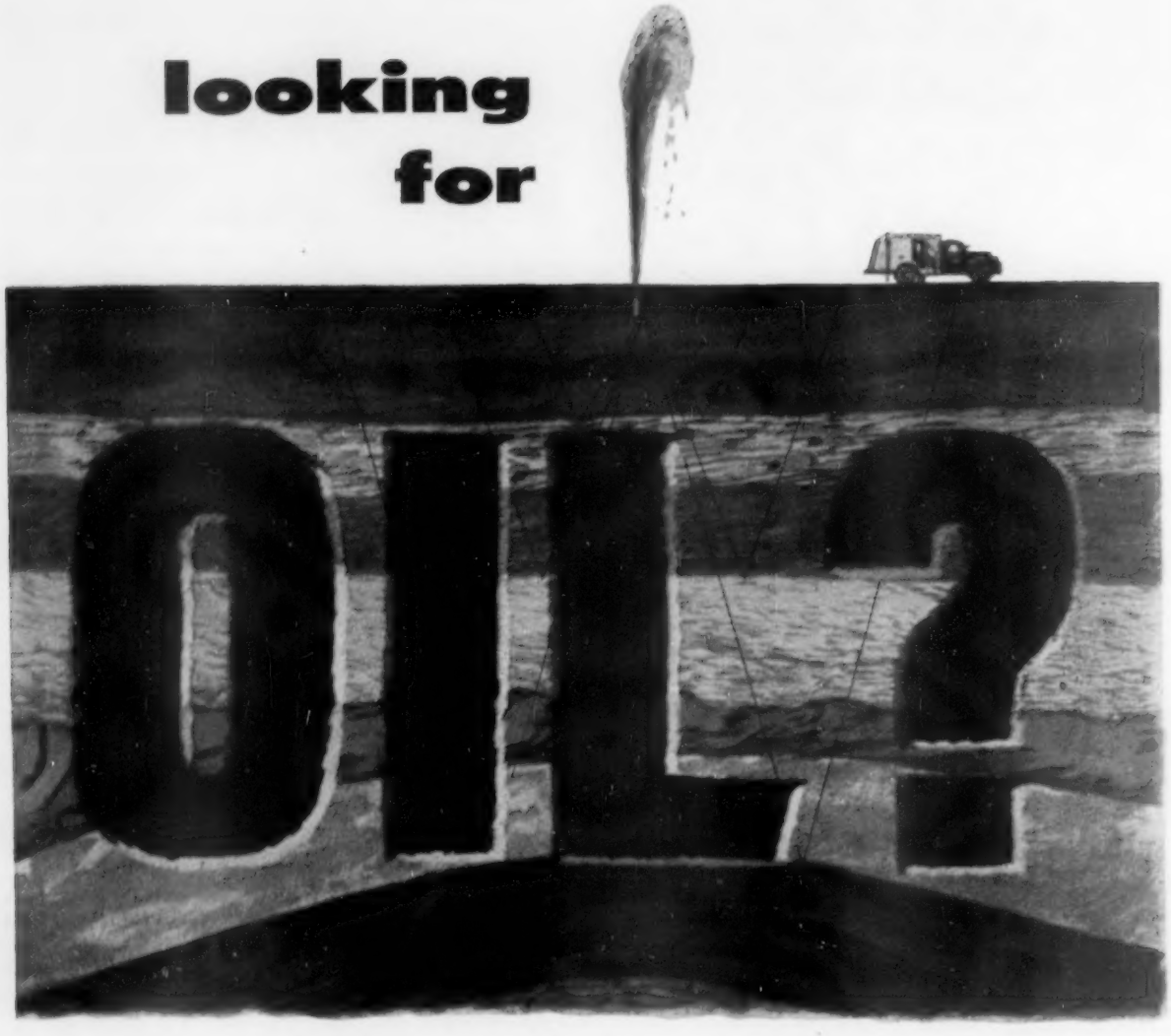
Libyan Well Below 6,000 Ft.

Libya's first wildcat is now down to 6,000 ft. and Libyan American Oil Co. (Texas Gulf Producing Co.) expects the test to enter Jurassic within a short distance.

Two oil stains have been encountered in Cretaceous. The company described them as unimportant traces.

The well is located in northern Cyrenaica east of Bengasi. It is being watched with interest as the first test in an untried region.

looking for



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Oil Shift Seen In Italy

Cities Service may get new concession as Gulf threatens to pull out because of tough provisions in new oil law

TWO major American oil companies met last week in the revolving door created by Italy's new tough oil legislation—one on the way in and the other threatening to leave.

Reports from Rome indicate the Italian Government is going to grant Cities Service Mid-East Co. four exploration permits in southeastern Italy under the terms of the new oil law. Gulf Oil Corp. a few days earlier, warned that it will pull out of the country unless the law is liberalized.

Cities Service was included in a list of a dozen companies slated to receive a total of 38 exploration permits covering 2,675,000 acres. All but Cities Service are Italian firms.

Cities Service has been interested in Italy for several years in spite of the oil law's terms that other companies regard as impossible. Officials of the company in New York have received no official notification of the government's intentions, but say they have people in Italy at work on possible concessions.

The new oil law limits a single exploration permit to 50,000 hectares (about 123,500 acres). No company may have more than 300,000 hectares in peninsular Italy or more than 150,000 hectares in any one region. The interest of Cities Service has been centered in southeastern Italy. The four permits mentioned in press reports from Rome last week are presumably in that section.

Gulf protest . . . Gulf's stand was revealed in Rome by Prince Nicolo Pignatelli Aragona, director general of Gulf Italia. He left no doubt that Gulf would not remain on the mainland if the law is approved. But he said the action would come only after the Senate voted on the bill, which already has passed the Chamber of Deputies.

Among the harsher provisions of the bill are a sliding scale of royalties. On a major discovery this would give a lion's share of the profit to the government, and place a limit of 7,413 acres that could be retained around each discovery well. The government monopoly would have the option to take remaining acreage *(The Oil and Gas Journal, July 16, page 82).*

Gulf at present has a considerable investment on the mainland. A subsidiary has made discoveries near the Adriatic Coast east of Rome. A different law applies in Sicily, where Gulf has developed Ragusa field.

Africa Test Hits Gas

French Cameroons find may be first to go commercial

PERSISTENT exploration in West Africa has turned up a gas-condensate discovery that may become the first field in the region to go on commercial production.

The find was made in the French Cameroons by Ste. des Petroles D'Afrique Equatoriale Francaise, which has worked in the area since 1952.

Commercial output, if developed, is expected to be small. But the one-well field would have the distinction of being the first fruit of exploration programs that have cost tens of millions of dollars in the Cameroons, neighboring Nigeria, and French Equatorial Africa *(The Oil and Gas Journal, August 27, page 80).*

The discovery was made in sandstone horizons from 6,000-7,500 ft. Pressure of 4,550-6,500 psi. was abnormally high for a well in the vicinity. The initial reserve estimate was 6,400,000 M.c.f. at 4,700 psi.

S.P.A.E.F. hopes to set up a small portable or semiportable gas plant to handle up to 10,000 M.c.f. daily. Carbon black would be made from the gas. Gasoline would be used locally. Laboratory tests on the gas and condensate are being made in Paris.

There is no outlet for natural-gas production in the area. Last year, a gas well was brought in with a preliminary estimated flow of 35,000 M.c.f. daily. It is believed shut-in *(The Oil and Gas Journal, July 18, 1955, page 80).*

More Supertankers Ordered

The trend to heftier tankers gained more headway late last month when orders were placed for three 60,000-tonners, the largest to be built in the United States.

The ships were ordered from Newport News Shipbuilding & Drydock Co., Newport News, Va., by Barracuda Tanker Corp., a newly formed, independent company.

The vessels will carry a maximum of 490,000 bbl. at a speed of 17.2 knots. They will be 792 ft. long, with 107-ft. beams and 41-ft. drafts. The first keel will be laid in a year. Deliveries will be made late in 1958 and early 1959.

Cost of the tankers is estimated at $15 million each. They will be leased to Union Oil Co. of California under long-term charter.

Meanwhile, the first of four 37,800-ton tankers under way at Newport News for Esso Shipping Co. will be launched October 11. The tanker will be the largest and fastest yet built for U. S. flag operation. It will be christened the Esso Gettysburg. A sister ship, Esso Washington, will be launched later in the year.

All four tankers will carry crude in the company's coastal trade. They could, if necessary, carry products.

Sicily Tests Mixed

Jersey affiliate gets good gasser, dry hole on island

EXTENSIVE tests on two gas discoveries in Sicily have indicated one well will be better than expected and the other a disappointment.

Augusta Ricerche Petrolifere, S.p.a., in which Standard Oil Co. (N.J.) has one-half interest, made the tests on 1 Bronte and 1 Vasadonna on licenses in northeastern Sicily.

The 1 Bronte, 9¼ miles west and slightly north of Mount Etna, was the better well. It had an open flow calculated at better than 4,000,000 cu. ft. daily, and will produce at 1,000,000 cu. ft. daily on regular production. The gas flowed from several sands between 3,880-4,150 ft.

A.R.P. has applied for a small development concession of a few hundred acres immediately surrounding the well. The 2 Bronte, 1 mile north, was a dry hole.

The Vasadonna well, 14 miles west of Catania and due south of Mount Etna, declined rapidly during the 20-day series of tests. The 6,640-ft. hole at first had been expected to produce about 1,000,000 cu. ft. daily. A light rig is being brought in to drill offsets, which will further evaluate the structure.

A new well, 1 Casteluzzo, has been spudded several miles south of 1 Bronte on a different structure.

Besides the Jersey Standard subsidiary, Gulf Italia Co., and British Petroleum, Ltd., are carrying on operations on Sicily. Ragusa field, discovered by Gulf in 1953, currently is producing better than 10,000 bbl. daily *(The Oil and Gas Journal, June 25, page 82).*

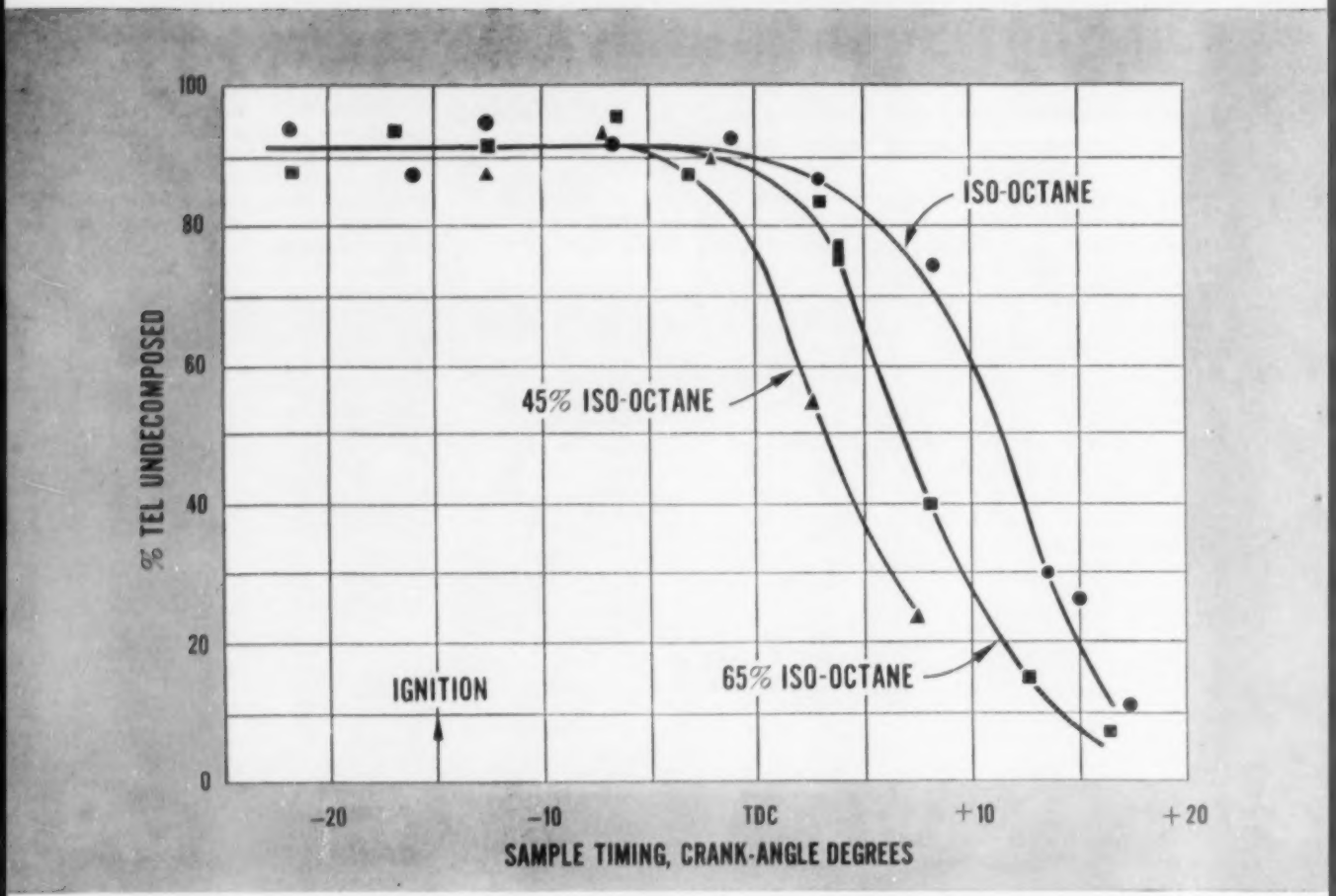


Fig. 1. TEL decomposition in fired engine. Fuels: mixtures of iso-octane and n-heptane containing 6 ml TEL per gallon.

New research on antiknock action

by ELLIS B. RIFKIN
Ethyl Corporation, Detroit, Mich.

Although tetraethyllead is widely used as an antiknock agent, some fundamentals of its action are still not completely understood. Since a full understanding of the mechanism of its action could presumably lead to increased effectiveness of utilization—the Ethyl Corporation conducts a continuing basic research program on antiknocks.

Many theories concerning the mechanism by which tetraethyllead acts as an antiknock in the internal combustion engine involve either the process by which tetraethyllead decomposes or the products resulting from such decomposition.

This report describes the studies of variables affecting the decomposition of tetraethyllead both in fired engines and in motored engines.

In a first series of experiments, a spark-ignited, fixed-compression ratio, L-head engine was employed. This engine was equipped with a sampling valve of special design which permits repetitive extraction of small samples from the end-gas region of the combustion chamber.

Mixtures of iso-octane and normal heptane were used as fuels, and end-gas samples were taken at 5° intervals from 25° before top center to 20° after top center. The results of these studies are indicated in Figure 1 which shows:

1. That essentially all the tetraethyllead is decomposed before the mixture is consumed by the flame front.

2. That the rate of tetraethyllead decomposition is markedly affected by fuel composition.

In order to resolve this effect of fuel composition more completely, it was decided to conduct a second series of experiments—this time in a motored engine, to permit measurement of temperatures. A single-cylinder engine was again used, but in this series of experiments, the engine was of the variable-compression ratio type to permit variation of temperature and pressure of the fuel-air mixture over as wide a range as possible.

Mixtures of iso-octane and normal heptane as well as di-isobutylene were the fuels tested. Figure 2 illustrates the effect of fuel composition on tet-

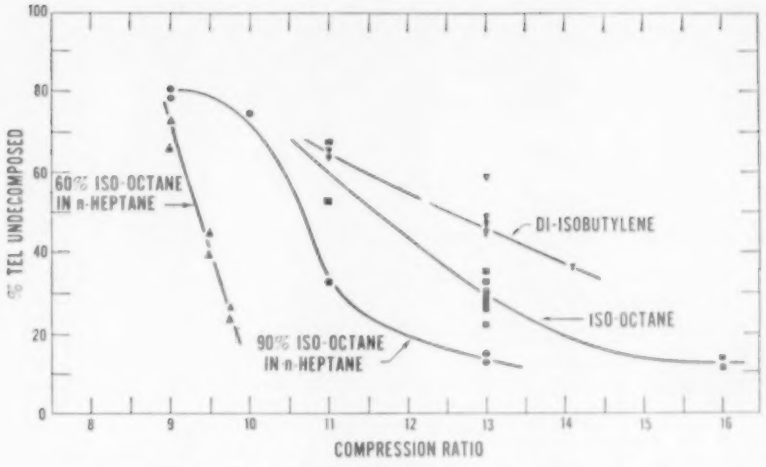


Fig. 2. Effect of fuel on TEL decomposition in a motored engine.

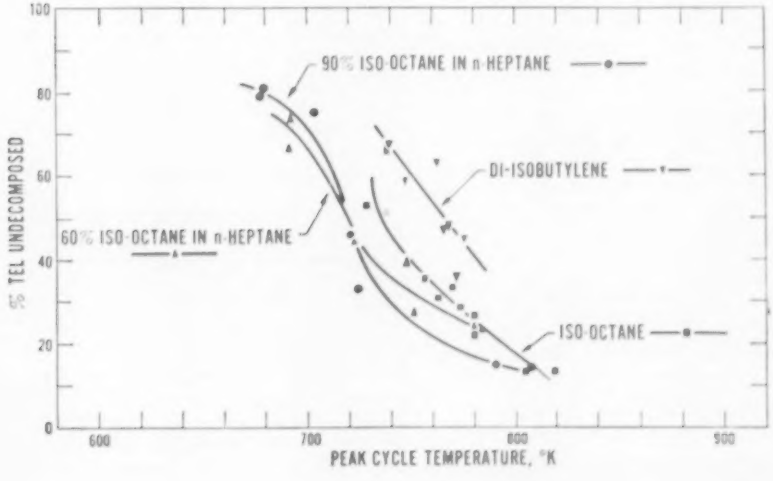
raethyllead decomposition in the motored engine—somewhat comparable data to that shown in Figure 1 for the fired-engine studies.

Again, an apparent correlation was obtained between fuel composition and rate of tetraethyllead decomposition—with the more rapid rates being associated with fuels of higher octane number.

To gain still greater insight into this relationship, technicians calculated peak cycle temperatures and the tetraethyllead decomposition data were examined against this variable. The results of this work are shown in Figure 3. It can be seen immediately that most of the variation due to fuel composition has been eliminated. This leads to the conclusion that temperature may be the one basic variable governing the decomposition of tetraethyllead—and that fuel composition has only an indirect influence so far as it affects the peak temperature of the charge in the cylinder. A mathematical analysis taking into account the variation in temperature of the charge throughout the cycle and comparison of those data with tetraethyllead decomposition data confirm this conclusion.

This account of one typical research project in the Ethyl Laboratories is designed to give you in the petroleum industry a glimpse into the vast body of continuing research being carried out to guarantee the maximum effectiveness of "Ethyl" Antiknock Compound.

Fig. 3. TEL decomposition in four fuels related to peak cycle temperature.



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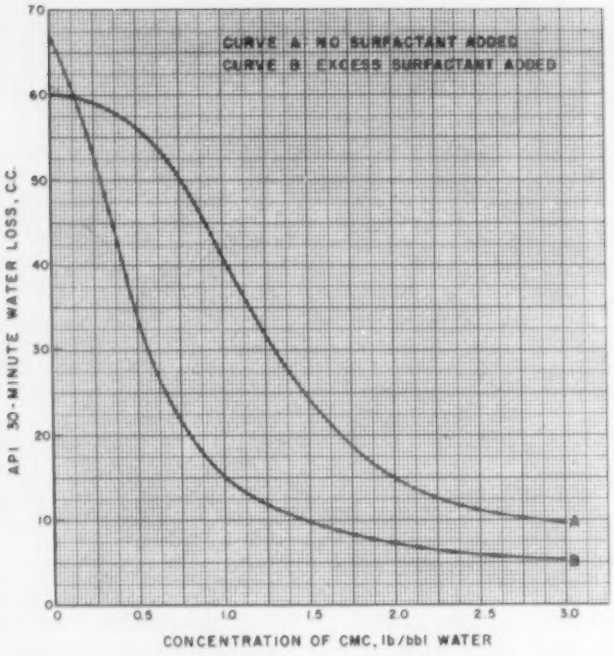
by R. F. Burdyn and L. D. Wiener
Field Research Laboratories, Magnolia Petroleum Co.

That New Drilling Fluid For Hot Holes



EFFECT OF CMC on water loss of calcium-containing muds. Fig. 1.

A new flocculated, neutral-pH drilling mud promises to eliminate most of the mud problems found in deep drilling. New types of surfactants provide lubricity and excellent chemical and thermal stability. It has allowed drilling of thousands of feet of previously undrillable shale and has stood up to temperatures of 400° F.

SURFACTANT muds have been successfully field-tested in the Gulf Coast area under a wide range of drilling conditions. Systems of this type can be compounded from a variety of flocculating electrolytes to give muds of varying electrical properties and solids-carrying capacities. Thus the composition of surfactant muds may be altered to meet the drilling requirements of the area in question with retention of their improved properties such as high lubricity, low viscosity, controlled solids-carrying capacities, ease of maintenance, and chemical and thermal stabilities. Through the use of these systems most of the mud problems encountered in deep drilling can be eliminated.

New concept . . . The search for oil at increasing depths and in areas presenting complex drilling problems has highlighted the defects of presently used drilling fluids and the need for their improvement.[1,2,3,4] Most mud maintenance and conditioning problems arise because the mud system cannot accommodate solids as fast as they enter the system through drilling or because some of the components of the mud have become thermally or chemically unstable. Although it is generally recognized that flocculated* muds possess higher solids-carrying capacities than dispersed types, maintenance of satisfactory rheological properties in flocculating environments has been difficult in the past.

In an effort to improve the technology of flocculated mud systems and, most importantly, to provide drilling fluids designed for efficient drilling operations, various nonionic surfactants have been incorporated into muds containing flocculating electrolytes. This new concept in drilling-mud control eliminates most of the defects of conventional drilling fluids. Ordinary dispersants have been eliminated, and the systems are allowed to reach their natural pH level, which is always between 7.0 and 9.0. The nonionic surface-active agents, all exhibiting high heat stability, plus soluble electrolytes are used to flocculate the clay solids in the mud and inhibit shale swelling.

The multifunctional combination of surfactants is designed to (1) increase the lubricity of the mud and emulsify any oil present, (2) increase the efficiency of filter-loss agents, and (3) aid in providing a flocculating environment. Through field testing under a variety of conditions, it has been shown that surfactant drilling fluids have a high solids-carrying capacity, are easy to maintain without extensive conditioning, and are limited in temperature only by the thermal stability of the water-loss reducing agent employed.

*Flocculated muds are considered in this article as being those muds in which the clays are converted to an aggregated form characterized by a plate-to-plate parallel stacking of the individual clay particles. The contribution of the clays to the viscosity is thereby greatly reduced and they act more as inert suspended solids. The type of controlled flocculation obtained with nonionic surfactants is desirable from several viewpoints, i.e., (1) the maintenance of lower viscosity in high-solids mud systems, and (2) the tendency to inhibit the dispersion of drilled clays and shales.

Field Applications

Field use of surfactant muds has thus far been limited mainly to systems flocculated with the aid of calcium ions. From its use in drilling a number of deep wells with total depths from 9,695 to 19,060 ft. and with bottom-hole logged temperatures up to 401° F, the following generalizations can be made regarding drilling operations with calcium surfactant muds. Mud-maintenance programs have been quite simple with little day-to-day changes in mud properties.

Exceptional hole stability has resulted in very close-to-gage holes. In several trials, very severe mud-making formations were penetrated with a minimum of extra mud conditioning. In one trial, 10,000 ft. of mud-making shale was drilled; this was a massive formation that had defied all previous efforts at penetration. Bit life and penetration rates in most cases were increased; casing was run and cemented with exceptional ease.

As bottom-hole circulating temperatures increased, mud returning to the surface generally had lower plastic viscosities and gel strengths. This has been ascribed to the degradation of the filter-control additive and dramatically demonstrated the complete lack of high-temperature thickening which has plagued other types of muds. In all wells, during periods when drilling operations have been suspended, the surfactant muds have shown exceptional stability, requiring only minor daily treatments.

Agents used . . . Calcium sulfate has been used as the principal source of calcium ion in these muds. Small amounts of calcium chloride have also been added when mud-making conditions were excessive. Approximately 600 p.p.m. of calcium ion is present in the filtrate at 70° F., when any excess of solid calcium sulfate is maintained and a relatively large excess may be used without adverse effect on the mud.

Since an excess of primary surfactant is also used, and this too may be varied within wide limits, the mud is exceptionally easy to maintain. The only additives required for this mud system are calcium sulfate, a primary surfactant-defoamant mixture, an emulsifier (when oil is used) and a water-loss reducing agent such as CMC (sodium carboxymethyl cellulose). When the primary surfactant and calcium sulfate are present in excess, and the water loss is maintained at the desired level by addition of water-loss reducing agent, control of viscosity is attained by addition of water to reduce viscosity or by the addition of clays to increase it.

Although the cost of chemicals is higher than in conventional lime muds, over-all costs are comparable in weighted muds because of decreased barite requirements. In addition, faster penetration rates, and a minimum of mud conditioning result in substantial savings in rig time and a sizable reduction in over-all drilling costs.

Future of Surfactant Muds

A calcium sulfate surfactant mud was chosen as the first type for field testing primarily because of the acute need for a stable mud system to use in deep exploratory drilling in the Gulf Coast

Neutral, flocculated surfactant muds are

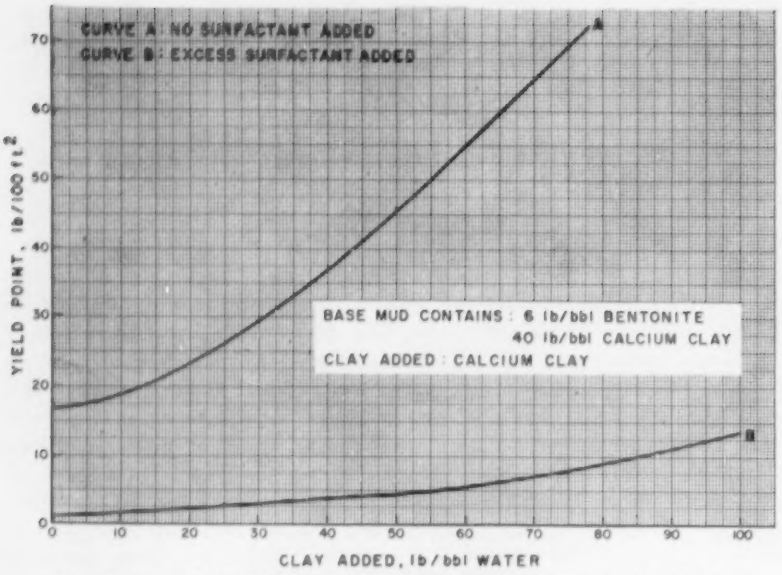
BETTER FOUR WAYS

1 High-temperature solidification occurs in water-base drilling fluids containing lime and caustic soda at temperatures above 250° F. These materials react with quartz, clays, and other siliceous matter in the mud to form cement-like products. Even before solidification becomes serious, the consumption of lime and caustic soda in these reactions makes mud maintenance increasingly difficult. In a low-lime system, where these materials are maintained at relatively low concentrations, their complete removal may occur during a single circulation. Avoidance of the cementation reactions may be accomplished by the use of any neutral mud.

2 When mud-conditioning times become excessive, over-all penetration rates are reduced due to the decrease in actual time spent drilling. Control difficulties with attendant hole troubles are caused by the chemical instability of mud components and by high viscosities which result from rapid solids buildup in active shale formations. High temperature and high pH are primarily responsible for the instability of mud additives. The use of heat-stable chemicals in a neutral environment effectively eliminates this problem. During drilling of "mud-making" shales, the rate of solids buildup in the mud and the viscosity imparted by these solids is increased by the presence of dispersants. Most electrolytes tend to reduce the mud-making tendency of active shales; however, in lime-base and other alkaline muds, a dispersing effect exists because such muds contain organic thinners and caustic soda. At the same time, the available calcium may be insufficient to completely base-exchange the clays or may be at a lower concentration than necessary for satisfactory inhibition of shale swelling. A neutral system containing a relatively high concentration of flocculants and no dispersants should minimize the mud-making tendency of shales containing highly dispersible clays.

3 For the reasons noted above, filtrates and the dispersants they carry into a formation may be responsible for poor hole condition. This is particularly true during drilling of shales where heaving and sloughing are possible. A neutral flocculated system should also minimize these effects.

4 Damage to a producing formation becomes most severe when a "dirty sand" is contacted by filtrates containing dispersants and when finely dispersed solids from the mud are forced into the formation during the initial buildup of a wall cake. Again, a neutral flocculated system would be desirable from the standpoint of minimizing both filtrate damage and particle invasion; mud particles are on the average larger in a flocculated system.



EFFECT OF ADDED SOLIDS on the yield point of fresh-water slurries. Fig. 2.

area. In addition to thermal stability, this type of system is characterized by high solids-carrying capacity. However, the inherent advantages gained by using neutral surfactant systems are not limited to this type of drilling; in fact, such systems can improve drilling performance under a variety of geological conditions.

For example, drilling fluids comprised of a moderate amount of sodium chloride (5,000-15,000 p.p.m.), nonionic surfactants, and polyanionic water-loss reducing agents such as sodium carboxymethyl cellulose or sodium polyacrylate have the same excellent drilling properties as those containing calcium ions.

In particular, the more thermally stable polyacrylate filter-control agents appear to be more compatible with the clays in sodium chloride systems than in calcium muds at temperatures above 300° F., and yield drilling fluids of exceptional thermal and chemical stability.

In offshore operations, where the supply of fresh water is often jeopardized by the weather, steady drilling programs could probably be maintained by the use of sea water in conjunction with nonionic surfactants. This combination of flocculants produces a highly inhibiting environment with accompanying very high solids-carrying capacities. Special high-viscosity types of polyanionic filter-control agents may find useful application in such systems.

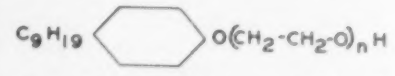
Surfactant muds employing saturated salt, sea-water, and 1 per cent salt are currently being used in three wells. A polyacrylate serves as a filler loss agent in the latter system.

The surfactants employed are organic compounds containing an oil-soluble group (hydrophobe) reacted with ethylene oxide which forms a water-soluble chain (hydrophile). For a given hydrophobe, water solubility is increased by increasing the length of the oxyethylene chain. The size of the hydrophobe in relation to the length of the oxyethylene chain determines to what extent the compound is water soluble, how actively it is adsorbed on clay surfaces or oil-water interfaces and, consequently, its function in the surfactant mud.

Generally, compounds of this type with little or no water solubility are good defoamants; those of limited water solubility produce foam but are good oil-in-water emulsifiers; while those within a broad range of water solubilities, including the emulsifiers, are clay flocculants. The whole range of compounds may be obtained with the same hydrophobe by varying the length of the oxyethylene chain. However, it can be shown that the efficiency of a compound for a particular use is dependent upon the hydrophobe size as well as the amount of ethylene oxide it contains.

A general characteristic of nonionic surfactants is the inverse solubility in water with temperature. In a drilling fluid this may be a disadvantage since a compound exhibiting only limited solubility at room temperature may be essentially insoluble at bottom-hole temperature, and cease to function properly.

These compounds are inherently thermally stable, with maximum stability achieved by connecting the hydrophobes to the oxyethylene chains through ether linkages. Since these materials are nonionic, they are more chemically inert toward electrolytes than many ionic surface-active agents. A typical example of a nonionic surfactant of the type described is the oxyethylated nonyl phenol shown below:



Here the hydrophobe, nonyl phenol, has been reacted with n moles of ethylene oxide.

It is evident that no single compound will necessarily provide all of the desired effects; consequently, a combination of surfactants is used which usually consists of three materials: the primary surfactant, a defoamant, and an emulsifier.*

Primary surfactant . . . The primary surfactant is selected to have the desired flocculating effect on clays commensurate with minimum foaming tendency and high water solubility. Its main function in a drilling fluid is the control of rheological properties by strongly adsorbing on the clay surfaces. In addition it increases the efficiency of polyanionic water-loss reducing agents, increases oil emulsion stability, and promotes better lubrication by adsorbing on metal surfaces.

Emulsifier . . . This surfactant is chosen to have high oil-emulsifying ability at high water solubility. Its purpose in the drilling fluid is to form a stable, fine oil emulsion and it is used only when oil is present. The emulsifier is within the broader class of primary surfactants; however, it is undesirable for this use because of its foaming tendency. Only small quantities of this material are required to produce the desired emulsion properties because of the presence of an excess of primary surfactant.

Defoamant . . . The defoamant is chosen for maximum antifoam properties at low concentration in the drilling fluids containing primary surfactant and emulsifier. It is a predominantly oil-soluble compound, structurally the same as the emulsifier but with a considerably shorter oxyethylene chain. It also enhances lubrication since it is adsorbed by metal surfaces.

Flocculating effect . . . The monolayer adsorption of these nonionic surfactants on clay surfaces has been demonstrated. In addition, X-ray studies have shown that, by adsorption, these materials can exhibit a flocculating effect

*Materials supplied by Antara Chemicals Division of General Aniline & Film Corp. as: DMS comprising the primary surfactant and defoamant, and DME comprising the emulsifier. DMS and DME are available through Milwhite Mud Sales Co., Magnet Cove Barium Corp., and Baroid Sales Division of National Lead Co.

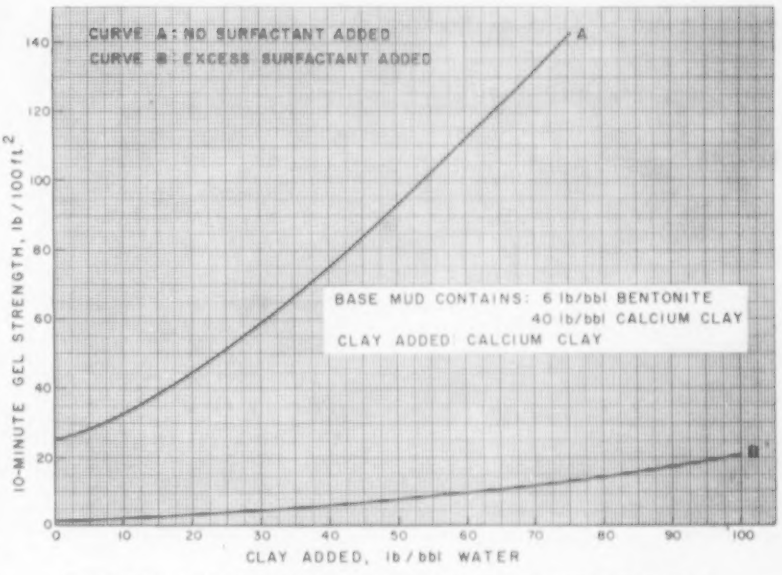
on clays.[5] Materials of this type, when used as primary surfactants in drilling fluids, must be present in sufficient amount to furnish monolayer coverage of the clays present. In order to treat clays accommodated in the mud during drilling, it is desirable to maintain an excess of surfactant.

The effect of the addition of these primary surfactants on the rheological properties of clay slurries serves as further evidence of their flocculating effect. Flocculation of the clays in a surface-to-surface stacking arrangement causes a marked reduction in plastic viscosity of the slurry since small particles are combined to form fewer, less asymmetric agglomerates. An illustration of this reduction in plastic viscosity of a 6 per cent commercial bentonite slurry is shown in Table 1.

As indicated by Table 1, the degree of flocculation achieved by the use of this surfactant is not as great as that achieved by the use of 10 per cent salt. However, by the use of the surfactant in conjunction with 10 per cent salt, a still higher degree of flocculation is observed. This complementary action of salt plus surfactant holds quite generally for the broad class of surfactants mentioned and for all of the common electrolytes such as sodium chloride, potassium chloride, calcium chloride, calcium sulfate, etc.

In particular, note that when a clay is flocculated using a surfactant, plastic viscosity, yield point, and gel strengths are all decreased, whereas when only salt is used, low plastic viscosity, high yield point, and high gels result. This latter behavior is always associated with sodium chloride and calcium sulfate muds and has been primarily responsible for restricting the use of such systems in the past.

It is of fundamental importance that such unsatisfactory rheological states do not occur when surfactants participate in the flocculation process. Furthermore, the use of the primary surfactant causes the flocculation of clays at salt concentrations common in most drilling muds, i.e., less than 10,000 p.p.m. Hence, the satisfactory electrical logging properties of muds with filtrate resistivities in 0.5 to 2.0-ohm-meter class may be retained at the same time that the benefits of a flocculated mud, such as high solids-carrying capacity, nondispersing filtrate, and decreased particle invasion into porous formations are realized.



EFFECT OF ADDED SOLIDS on the gel strength of fresh-water slurries. Fig. 3.

Effect on fluid loss . . . The fluid loss of flocculated systems is somewhat higher than that of dispersed systems because particle size is greater and particle-size distribution is narrower. In addition, the efficiency of the water-loss reducing agents employed in salt-containing systems is modified due to their adsorption on clay surfaces. Since the primary surfactant is preferentially adsorbed on clay surfaces, it substantially reduces the amount of water loss agent required to achieve a given level of filtration control. Fig. 1 shows this effect in a system in which CMC is used to control water loss and in which calcium sulfate is used as a flocculating electrolyte. As in other muds, a lower water loss may be achieved by the use of emulsified oil.

Inhibiting clay swelling . . . As well as flocculating any clays which have been previously dispersed in the mud, the primary surfactants, when present in excess, will inhibit the dispersing and swelling tendency of clays entering a mud system. To demonstrate this effect, Table 2 shows the effect of order of addition of bentonite and surfactant to water on the rheological properties of a 6 per cent bentonite slurry.

Figs. 2 and 3 show the variation in yield point and 10-minute gel strength, respectively, with added solids of an untreated clay slurry as compared to similar slurries treated with a primary surfactant. It is noted that considerably more solids can be added to a slurry containing surfactant before the yield point and gel strengths become excessive.

TABLE 1—PROPERTIES OF BENTONITE SLURRIES* TREATED WITH EXCESS PRIMARY SURFACTANT

Treatment	Plastic viscosity (cp.)	Yield point (lb./100 ft.²)	Gel strength Initial (lb./100 ft.²)	Gel strength 10-Min. (lb./100 ft.²)
None	41	30	12	43
Surfactant	33	12	1	23
10 per cent salt	12	73	43	47
10 per cent salt + surfactant	3	1	1	1

*Six weight per cent commercial bentonite in distilled water.

TABLE 2—EFFECT OF ORDER OF PRIMARY SURFACTANT ADDITION ON SLURRY PROPERTIES

Order of addition to water	Plastic viscosity (cp.)	Yield point (lb./100 ft.²)	Gel strength Initial (lb./100 ft.²)	Gel strength 10-Min. (lb./100 ft.²)
Bentonite—no surfactant	36	24	4	30
Bentonite—surfactant	33	12	1+	15
Surfactant—bentonite	18	5	<1	9

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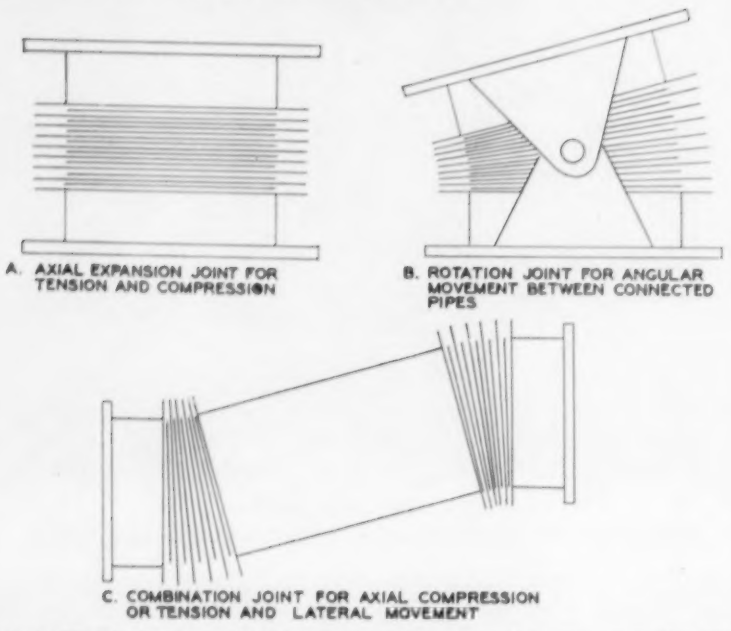

A. AXIAL EXPANSION JOINT FOR TENSION AND COMPRESSION
B. ROTATION JOINT FOR ANGULAR MOVEMENT BETWEEN CONNECTED PIPES
C. COMBINATION JOINT FOR AXIAL COMPRESSION OR TENSION AND LATERAL MOVEMENT

THESE THREE TYPES of flexible pipe joints may be used in the cat cracker piping system. Fig. 1.

FLEXIBLE PIPE JOINTS

. . . How to design and maintain them

Flexible pipe joints absorb compression, tension, angular movement, and lateral movement due to thermal expansion in the catalytic cracker piping system.

by J. S. Clarke

WHEN handling catalytic cracking catalyst, it is not always possible to lay out piping so that it will have enough flexibility to absorb thermal expansion. Furthermore, it usually is necessary to minimize the length of piping between two points and, because of the nature of fluidized catalyst, it is not feasible to employ expansion loops.

In these cases, expansion joints are used. These are pipe-section members which flex in such manner as to absorb compression, tension, angular movement, or any combination of these types of movement.

At best, expansion joints are the weakest link in the chain, and their use is undesirable for this reason, also they are costly to install and maintain. Where their use cannot be avoided, however, much can be done to insure safe installation and reasonable service life.

Author is with Esso Research & Engineering Co., Linden, N. J.

Types of joints . . . Expansion joints as used in catalytic cracking units consist of one or more bellows made up generally of a number of stainless-steel annular members joined together alternately at their inner and outer peripheries. This, the basic component, is supplemented by connecting it into the pipeline, movement limiting devices, and other auxiliaries.

Various types of flexible joints are shown diagramatically by Fig. 1 in which (a) indicates a joint designed for axial compression or tension, (b) is a rotation joint designed to absorb angular movement between connecting pipes, and (c) is a combination joint capable of accommodating axial compression or tension and lateral movement as well.

Fig. 2 shows the details of a combination joint. This one was chosen for illustration because it is the more complicated.

Sleeve elements . . . A sleeve is provided inside the joint to isolate the bellows assembly from the flowing stream. This sleeve may carry an erosion-resistant or heat-insulating liner depending upon the nature and temperature of the flowing stream.

A purge gas, usually steam or air, is provided in the space between the sleeve and the bellows to keep out catalyst or corrosive condensables. The amount supplied is sufficient to give a velocity of about 5 ft. per second where it issues from behind the sleeve.

The most recent technique, which provides improved distribution, is to introduce the purge medium through a so-called molehill. This is a ring of half-pipe welded around the pipe section of the joint over a number of small holes. These connect to the space between the sleeve and the bellows. The purge gas is connected to the molehill by a single connection and enters the joint through the many small holes.

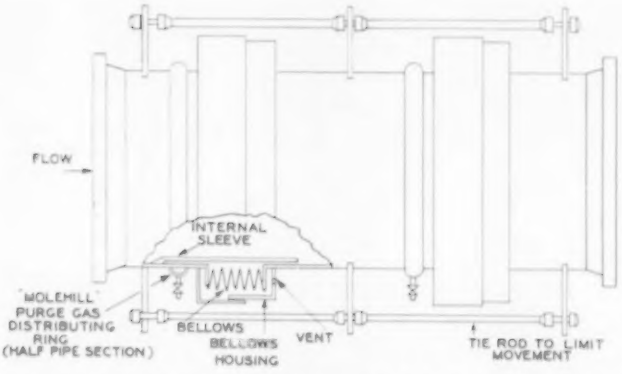
Where axial or combination joints have several bellows sections, there is the problem of supporting the intermediate components of the joint. If the joint is mounted horizontally, the intermediate bellows and connecting pipe sections tend to sag. If the joint is in a vertical position, these members tend to drop, compressing the lower bellows and stretching the upper ones.

This situation is controlled in the more recently built joints by a pantograph arrangement which equalizes movement between the various bellows and carries the weight of intermediate members. Fig. 3 shows a joint with a pantograph support.

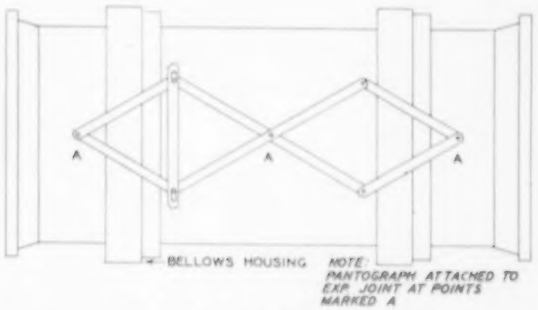
Expansion-Joint Design

Expansion joints must be designed for the specified type and amount of movement to be absorbed and also for the internal pressure to be applied. Factors to be considered are the cold conditions when the unit is shut down, startup conditions, normal operating conditions, and emergency conditions, such as blower failure, catalyst blocking of lines, etc.

In general, the joint should be designed to accommodate the usual leakage-test pressure which is put on the unit prior to startup but not the strength-test pressure for connecting vessels or lines. For strength tests the joint may



DETAILS OF COMBINATION JOINT—one of the more complicated types. Fig. 2.



PANTOGRAPH ARRANGEMENT equalizes movement between bellows and flexible joints. Fig. 3.

be removed and replaced by a spool piece or the connecting flanges in the lines may be blinded or blanked.

Basic design procedures for annular-type expansion joints were established by Esso Engineering engineers after a series of costly expansion joint failures. This design basis limited the stress in the bellows elements to a maximum of 25,000 psi. For joints having flat (actually slightly conical) annular-bellows elements, the following equation was developed and confirmed by extensive tests for relating stress to movement, pressure, and other variables involved:

$$S_t = 3Etd/L^2 + L^2p/2t^2 \qquad (1)$$

Where:

S_t = total stress in the element, psi.
E = Young's modulus for element material, psi.
t = thickness of element, in.
L = annular distance between inner and outer welds on element, in.
p = internal pressure, psi.
d = movement per element, in.

The stress due to deflection or movement is given by the term $3Etd/L^2$, designated S_d, and the stress due to internal pressure is given by the term $L^2p/2t^2$, designated S_p. These stresses are additive to give the total stress S_t.

There is an optimum relationship between the element thickness t and its width L which gives the maximum movement for a given pressure and allowable stress. This relationship is obtained by differentiating Equation 1 with respect to L and equating the result to zero. The following relation is obtained in this manner:

$$L/t = (S_t/p)^{1/2} \qquad (2)$$

Stresses equal . . . At this optimum condition the stress due to design pressure is equal to the stress due to design movement. By designing a joint to satisfy this equation, the required deflection can be obtained with the minimum number of bellows elements.

Substituting Equation 2 in Equation 1 gives the maximum movement per element under optimum conditions:

$$d = \frac{S_t^2 \times t}{6pE} \qquad (3)$$

Bellows elements are constructed only of 18-8 chrome-nickel steel Type 347 for which the following values are used:

E = 28,500,000 lb. per sq. in.; S_t = 25,000 lb. per sq. in.

On the basis of these values and Equation 3, the following formulas have been derived to determine the number of elements required for specific values of pressure and movement:

For angular movement:

$$N = pD\theta/420\,t \qquad (4)$$

For axial movement:

$$N = pe/3.66\,t \qquad (5)$$

For combined axial and lateral movement:

$$N = p/3.66\,t\,(e + Df/A) \qquad (6)$$

Where:

N = number of bellows elements required in joint.
D = mean diameter of elements, in.
A = length of pipe section between bellows, in.
e = design axial movement, in.
f = design lateral movement, in.
θ = design angular movement, deg.

In some instances the force exerted by a joint in compression or extension may be critical in the design of adjacent piping. This force may be evaluated as follows:

$$P = ED\,(t/L)^3\,e'/N \qquad (7)$$

Where:

P = compression or extension force in lb.
e' = axial movement relative to neutral position, in.

The moment necessary to rotate a hinge joint is:

$$M = \frac{ED^3\,t^3 \sin\theta}{8L^3\,N} \qquad (8)$$

Where:

M = moment in in.-lb.

Installation and Operation

By using the proper techniques in installing expansion joints, the design movement of the joint can be reduced to about half of the required movement. This is done by presetting the joint under cold conditions to a position equal and opposite from neutral position to the hot position. For example, if an axial joint were to absorb 2 in. of compression, it would be installed so that it is stretched 1 in. in the cold position.

As the lines warm up, they would expand with temperature, first moving the joint from its extended position to neutral position and then compressing the joint 1 in. beyond neutral. The total movement absorbed by the joint would be 2 in., but its design movement would need to be only 1 in.

The same technique is applied to rotation and combination joints. Actually, the design rating should exceed normal movement by some reasonable amount and because of this the design rating usually is somewhat greater than half the required movement.

Flow direction . . . Probably the most difficult position for an expansion joint to occupy is in a vertical line with upflow of catalyst. In this case, it is somewhat more difficult to prevent catalyst from settling into the space between the sleeve and the bellows. If catalyst enters this space, even in small

amounts, two problems are apt to be encountered:

1. Packing of catalyst between the bellows elements which may distort or rupture the elements when the joint moves. This is least likely to happen in an axial joint which operates in a compressed position and will be most likely to happen in a rotation joint since with rotation in either direction one side always moves to close the angle between the adjacent elements.

2. Erosion will be caused by particles of catalyst circulating locally in the aeration medium in the space between the sleeve and the bellows. There have been several cases where the bellows were cut through because of this erosion.

In any type of joint, it is of the utmost importance that the purge medium be from a reliable source. The purge medium should be introduced before catalyst is added to the unit and should not be cut out until the unit approaches standby temperatures on shutdown. The purge should not be taken out of the joint during plant operation without full cognizance that lack of purge may result in loss of the joint.

Variation of residual position . . . Materials subjected to stress at elevated temperatures tend to deform or creep. This effect is apt to be encountered in catalyst piping making the cold position of a joint somewhat different at the end of a run than the beginning of the run.

If the cold position of a joint changes because of this or other similar causes by more than 20 per cent of its rated movement, the line should be cut near the joint at a convenient point and rewelded in a position to bring the joint to its proper cold position.

Resetting the cold position of joints has been accomplished in some cases by inserting flat or wedged-shaped annular members between the flanges of the joint and connecting pipe.

Limit stops . . . Tie rods or other similar devices are provided on joints to limit movement to allowable values. These members are useful also in clamping the joint in a fixed position for shipment or handling. When installing a joint for the first time, it is convenient to use the limit stops to hold the joint in the proper cold position while welding adjacent pipe to conform to this setting of the joint.

The limit stops are not intended to restrain pipe or joint movements. Their distortion should not cause alarm if it occurs under emergency conditions which cause excessive deflection of the joint. Joints designed on the current Esso Engineering basis are capable of absorbing a limited number of movements considerably beyond design values.

Provided rupture of the bellows does not occur, such movements usually do not cause immediate damage but their consequence may be a shortening of the life of the joint. Joints that have been distorted because of excessive movement may have to be repositioned allowing their subsequent movements to bear the proper relation to a different neutral position.

Bellows housing . . . A ¼-in. carbon-steel housing as shown in Fig. 2 is provided around each bellows of all flexible pipe joints to prevent the bellows from being damaged during installation or handling. This housing also provides a means of sealing off the bellows should a leak occur during operation.

This is accomplished by installing a nipple and open vent valve in one of the couplings provided and then seal welding the space between the two sections of the housing.

A second coupling is provided as a drain or for use in conjunction with the vent to steam out while welding. After welding, the drain is plugged and the vent valve shut. This operation should be accomplished only in conformance with safety procedures associated with welding on hot equipment.

Where a bellows has been boxed in as described, the box should be cut loose as soon as possible during comedown to minimize distortion as temperatures drop.

Allowable pressures . . . With joints designed on the basis described herein, at rated pressure and movement the stress due to pressure and the stress due to movement would be equal. The sum of these stresses would be the allowable design stress for the bellows material (normally 25,000 psi.). It follows, then, that with no pressure on the joint, it may be deflected twice design amount.

Also, with the joint in neutral position, i.e., no deflection, twice design pressure may be applied without exceeding allowable stress. Similarly, at half deflection, one and a half times design pressure may be applied, etc. A knowledge of these relations in operating conditions for joints may be of use in connection with evaluating the effects of emergency conditions, pressure testing of joints or equipment to which they are connected, and rerating joints for different service conditions.

Another extension of design values which may be employed if necessary for short duration is an increase in allowable stress. Where there is urgent need, the allowable stress may be increased to 35,000 psi. without serious damage to the bellows. A typical instance where this might apply would be in strength or leakage tests on the unit where removal of the joint would entail unusual difficulties or delay plant operations.

This step must be used with caution, however, and the actual design stress for the joint checked first since in many cases it has been necessary to use higher-than-normal design stresses in replacement joints because space limitations did not permit the joint to be built with the calculated number of bellows elements.

Maintenance of Joints

When the unit comes down for turnaround, all expansion joints should be examined thoroughly and repairs made where necessary. Joints that have failed during the run or those known to need repairs are removed. Otherwise, current practice is to examine the joints in place in the unit since removal and handling are difficult and it usually is necessary to improvise supports for connecting lines when the joints are taken out.

The most critical part of the joint is the bellows. In general this should be inspected from within at the end of every run of 6 months or more and from the outside at least every 2 years. To inspect the inside of the bellows, it is necessary to remove the sleeve or to cut windows in it at sufficient points to obtain reliable indications of its condition.

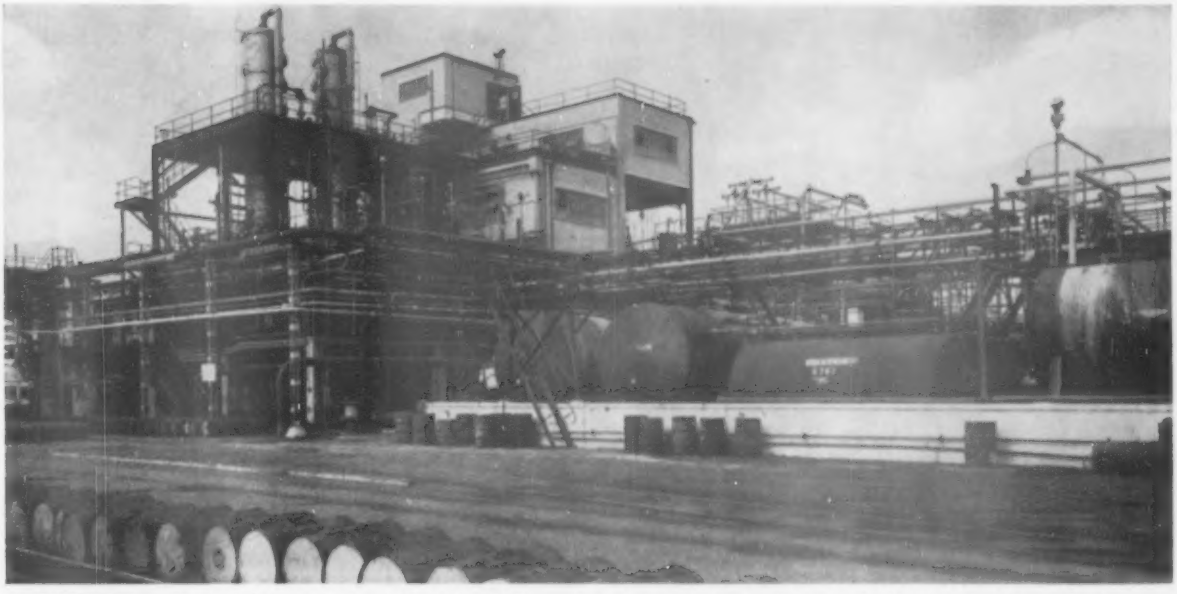
Erosion and corrosion are the main factors affecting the bellows in properly designed joints. Other causes of difficulty are excessive stress and, associated with this, stress-corrosion cracking.

Repair work . . . Where major repairs are required on the bellows, the work usually is handled by the manufacturer of the joint since specialized techniques and equipment usually are necessary.

The refinery shops or a local contractor should be able to handle other maintenance work on joints such as: (1) replacement of entire bellows; (2) repairs to sleeve; (3) refacing or aligning flanges; (4) erosion of joint internals except bellows; and (5) reconditioning hinge pins or bearings.

Prior to leaving the shop, a leakage test should be made on the joint. A pressure test may be required.

It is common practice to have spare bellows assemblies in stock for all joints. Then when inspection indicates the bellows must be discarded or needs major repairs, a replacement will be immediately available. Occasionally spare bellows elements are held in stock either by the refinery or by the joint manufacturer to insure immediate availability when repair work by the manufacturer is necessary.



SANTOMERSE PLANT of Monsanto Chemicals, Ltd., at Newport, Wales. This plant will shortly begin the manufacture of polystyrene and synthetic rubber.

Esso to spend $25,000,000 in a program that in 3 years has seen

Petrochemicals Rise 40 Per Cent in U. K.

Biggest developments in synthetic ethyl alcohol, plastics, rubber, and detergents

SINCE 1953 output of the U. K. petrochemical industry has risen by over 40 per cent. The carbon content of such products produced was placed at around 180,000 tons last year, and the import of feed-stock and refinery gases at an annual rate of 700,000 long tons. In 1955 about one-third of all organic chemicals used in Britain was derived from oil.

Several major projects have recently been initiated, which will increase the size of the industry by two-thirds, at an estimated cost exceeding $84,000,000 by 1958. The biggest developments are in the field of synthetic ethyl alcohol, raw materials for plastics, synthetic rubber, and detergents.

Esso Petroleum enters . . . The most important recent United Kingdom's development was the announcement in April that Esso Petroleum was entering the petrochemical field for the first time. It plans to spend $25,000,000 over the next 2 years at Fawley on a plant that will process from 250,000 tons of feed stock a variety of chemical materials including ethylene, propylene, butylene, and butadiene.

Most of the butadiene and probably some of the ethylene from this plant will be fed to the U.K.'s first big synthetic-rubber plant to be built by International Synthetic Rubber Co., formed by Dunlop, Goodyear, Firestone, and Michelin, near Fawley refinery, at an outlay of $14,000,000. This installation will require approximately 37,500 long tons of butadiene and 12,500 tons of styrene (made from ethylene).

If Monsanto decides to enter this field, this would bring the number of companies interested in polythene to four. The company is considering a high-pressure plant near Fawley. At present Imperial Chemical Industries, Ltd., is the sole British producer of this plastic, although patent for its manufacture by the high-pressure polymerization of ethylene expired last February.

In July 1955, Union Carbide & Carbon Co. (U.S.) announced its intention to manufacture high-pressure polythene at Grangemouth, its plant being scheduled for operation the coming fall. This plant will have an initial capacity of 11,500 tons and cost around $12,000,000. It will get its ethylene from the British Petroleum refinery at Grangemouth.

PETROCHEMICALS

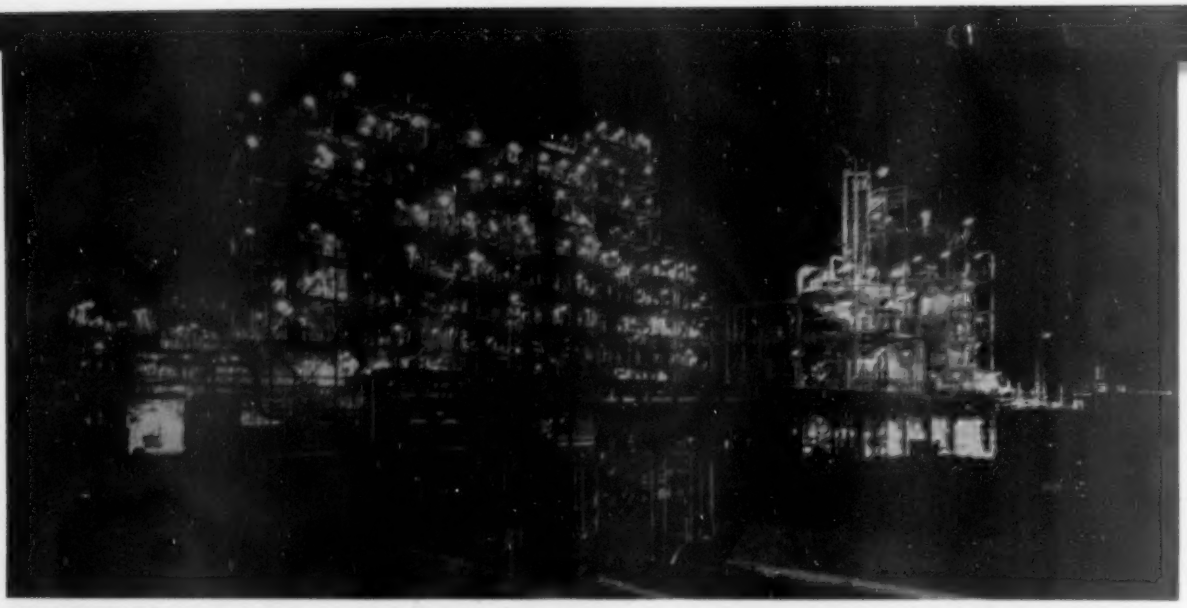
In addition, Petrochemicals, which was taken over by Shell Chemicals last year, has an exclusive license for exploiting in Britain the Ziegler process of producing polythene under low pressure. It is believed that a pilot plant is under operation.

British Celanese was pioneer in the petrochemical field. During the early part of the last war it operated a plant at Spondon producing materials for cellulose, acetate rayon, and plastics. This unit will soon be manufacturing vinyl acetate for use in emulsion paints.

I.C.I. Expansions

At Wilton I.C.I. is now engaged in building a second oil cracker—the first was completed in 1951—which will double the company's capacity for processing naphtha to 8,000 long tons a week before the end of this year.

Ethylene from the cracker will be used chiefly for the big polythene expansion program this company is engaged in. Butadiene from the new butadiene-extraction plant will be used in its 10,000-ton synthetic-rubber plant. This unit is scheduled for completion late this year at an outlay of $11,200,000. Capacity for paraxylene and Te ylene has also just been doubled.



THE OLEFIN PLANT at the Wilton works of Imperial Chemical Industries. I.C.I. is currently expanding its polyethylene operations.

The second 5,000-ton Terylene plant will shortly be in quantity production.

At Billingham, I.C.I. is also expanding its higher alcohol plant's capacity to 40,000 tons, valued at $14,000,000 annually. Among the chief products will be plasticizers used in the manufacture of polyvinyl chloride—the capacity for which is also being doubled. In addition, the Billingham division has a large project under way for the manufacture of ammonia from heavy oil.

Wilton olefin plant . . . The Wilton works provides a manufacturing center for organic chemicals, the production of which is controlled independently by the six I.C.I. divisions concerned. Automatic control and advanced design are featured in one of the largest plants at Wilton—the olefin works, currently processing 4,000 tons of naphtha a week.

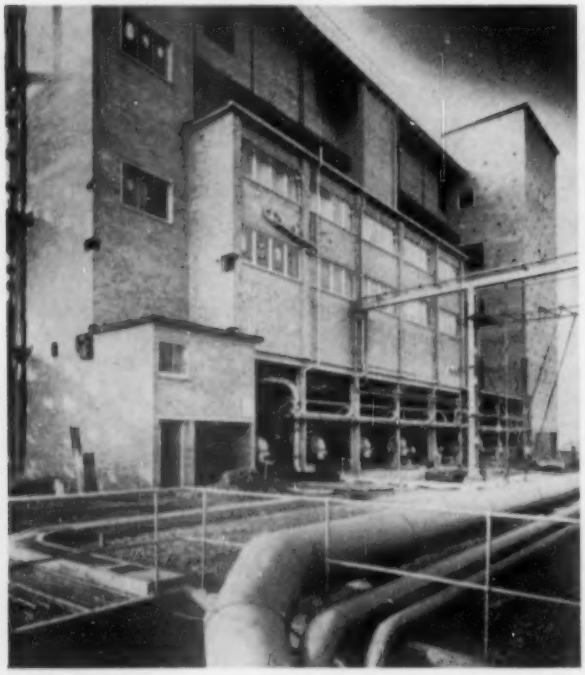
This plant produces a range of gases, gasoline fractions, and a certain amount of oil; but its main product is ethylene. In a nearby plant run by the Alkali Division this ethylene is compressed and processed into polythene.

The plant also supplies ethylene for making ethylene oxide and ethylene glycol on adjacent plants. Part of the ethylene glycol is marketed as antifreeze and part of it is used at Wilton in the manufacture of Terylene fibers. The ethylene oxide is employed to make Lissapol—an industrial detergent.

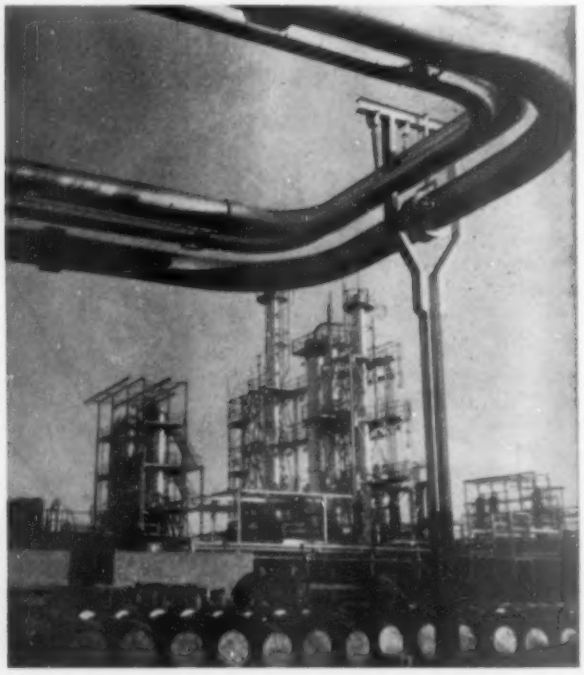
This plant sends most of its by-products to the Billingham Division's main works via the pipeline under the River Tees. In many cases these items return to Wilton in a developed form —thus the olefin works is linked with the production of Perspex plastic.

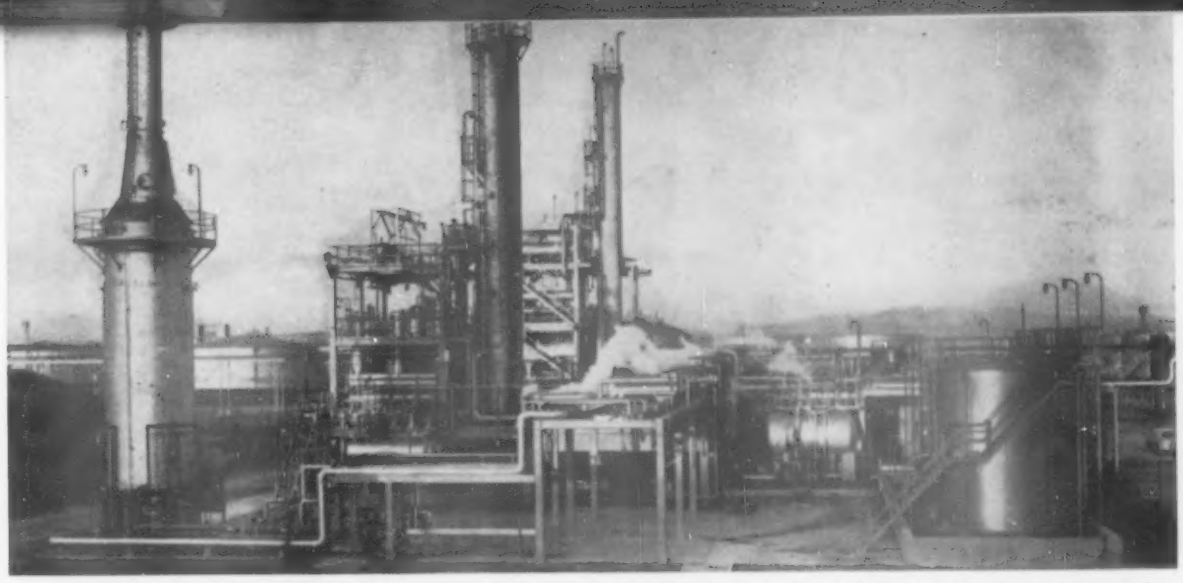
Pyrolysis plant . . . The I.C.I. petroleum pyrolysis plant covers an area of approximately 700,000 sq. ft., and is

POLYMER BUILDING at the I.C.I. Terylene plant at Wilton, North Yorkshire. The plant has a capacity of some 22,000,000 lb. per year of filament yarn.



ESTER SALTS PLANT at Shell's Stanlow works. The wax-cracking unit is at left. Redistillation and solvents-recovery units are in the center.





DETERGENT ALKYLATE PLANT of British Petroleum Co., Ltd., at Grangemouth, Scotland. British Hydrocarbon Chemicals, an affiliate, will soon double its olefin production.

mainly operated from two central control rooms, where the network of pneumatic control circuits terminates in some 250 control instruments and alarm indicators.

From the first control room the cracking of oil by contact with superheated steam and the initial stage of distillation—in which fuel oil is taken off—are controlled. Electric pumps automatically take the cracked product on through compressors into the installation where the gases are separated by distillation at a temperature below minus 100° C.

The gas plant is controlled by only 17 men on each shift. This contrasts with a total of between 30 and 40 persons employed during the day on maintenance.

Several plants are under construction at Wilton, including a 10,000-ton-a-year nylon plant. The Wilton works has so far cost around $140,000,000 with half as much again already authorized. The company is spending around $2,800,000 a month to make Wilton one of the largest and most modern plants in Britain, or anywhere else. The 18 plants located at Wilton operate continuously throughout the week under the control of about 500 men in each shift. There are approximately three maintenance workers for every two engaged on processes, which in 1955 accounted for over 300,000 tons of products ranging from polythene to Terylene.

More olefins . . . Another major scheme now in progress is the $22,400,000 project of British Hydrocarbon Chemicals at Grangemouth in Scotland. The output of olefins is to be doubled. The original cracking and gas separation units and the synthetic-alcohol plant will, in all essential respects, be doubled. New units are being built for the extraction of butadiene and to produce tetrapropylene.

Last year, the U.K. output of ethyl alcohol was nearly 100,000 long tons, of which 30,000 tons was derived from Grangemouth, and the remainder by the traditional fermentation of molasses.

The Grangemouth unit of Grangemouth Chemicals, Ltd., was commissioned late in 1955, and it is producing detergent alkylate at its design output of 10,000 tons a year. Grangemouth Chemicals, Ltd., is jointly owned by British Hydrocarbon Chemicals, Ltd. (owned 50-50 by British Petroleum Co., Ltd., and Distillers' Co., Ltd.), and Oronite Chemical Co. (wholly owned subsidiary of Standard Oil Co. of California).

The plant product is dodecylbenzene (tetrapropylene benzene or detergent alkylate) convertible to a wetting agent and detergent by reaction with sulfuric acid and neutralization. The raw materials, propylene tetramer and benzene, are converted to dodecylbenzene by a continuous catalytic process employing anhydrous liquid hydrofluoric acid.

Propylene tetramer is made in the nearby oil refinery by polymerization of propylene, and it is also to be obtained from a new plant under construction by British Hydrocarbon Chemicals, Ltd. Pure coal-tar benzene is derived from indigenous sources.

New tetramer plant . . . This new tetramer plant, costing approximately $2,800,000, was designed on Oronite process data by Stone & Webster Engineering Corp., Boston, but the equipment was essentially purchased and fabricated locally.

Procurement and supervision of construction were carried out by E. B. Badger & Sons, Ltd., and site erection by Costain John Brown, Ltd. It is located within the factory area of British Hydrocarbon Chemicals, Ltd., and draws essential services from the main factory.

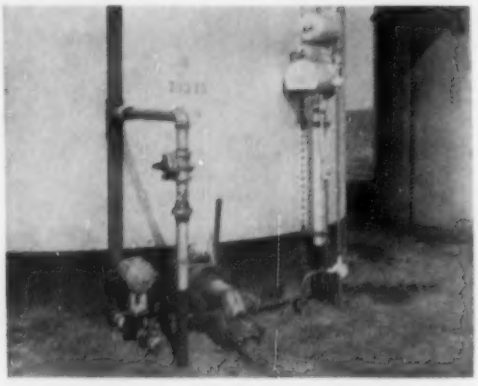
Styrene plant . . . Another installation, shortly to come on stream, is the extension to the styrene monomer plant of Forth Chemicals (jointly owned by British Hydrocarbon Chemicals and Monsanto), drawing its ethylene from Grangemouth. Its annual capacity will then exceed 20,000 tons.

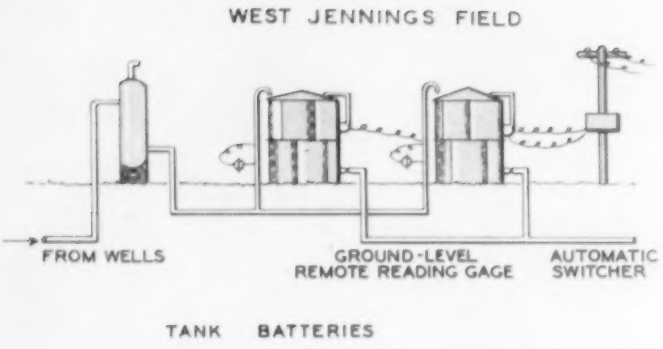
In 1955 the U.K. imports of styrene monomer amounted to 12,000 long tons. Styrene from this plant will be available for the manufacture of rubber and polystyrene. Monsanto will shortly complete major polystyrene extensions at Newport in Wales, and its 4,000-ton synthetic rubber plant is also to be commissioned soon.

The largest project which Shell Chemical Co. has under construction is its $18,200,000 installation to produce 75,000 long tons of ammonia per year from petroleum at Shellhaven. Nearly 60,000 tons of the ammonia will be used by Fisons in a new $12,600,000 nitrogenous fertilizer plant.

Shell will also shortly bring into full production its $3,500,000, 20,000-ton alkyl benzene plant (a raw material for synthetic detergents) at Shellhaven.

In the United States, which had a 20-year start on Western Europe in petrochemical production, output of petrochemicals derived from oil and natural gas in 1955 was approximately 15 million tons representing 80 per cent of all United States organic chemical production, when the corresponding proportion in the United Kingdom was about 33 per cent. These figures give some indication of the future potentialities of chemicals from oil in Britain.





Automatic Switching, 9-Mile Radio Link,

Part of The Texas Co.'s production facilities for West Jennings field are two 5,000-bbl. tanks which are 9 miles by air and 25 miles by road away from the rest of the operations. To save the pumpers the 50-mile round trip to those tanks each day, The Texas Co. has installed automatic switching and remote gaging. The distance between field and tanks is spanned by a radio link, which cost only about one-third as much as a conventional pole-and-wire connection would have. The Texas Co. has made further savings by also putting automatic switching and remote gaging on all tank batteries in the field proper.

by Ed McGhee
District Editor

THE TEXAS CO. produces 89 wells in its Jennings field of Zapata County, Texas. Crude from these wells is sold to a pipeline company at its station at Thompsonville, 9 air miles away. The Texas Co. has two 5,000-bbl. tanks at Thompsonville into which the West Jennings crude is pumped. The pipeline company takes delivery of the oil after it is in these tanks.

So, the pumpers of The Texas Co.'s production department have to gather the oil from the West Jennings batteries and pump it to the Thompsonville tanks where it is sold. The situation is complicated by the fact that the road to Thompsonville is extremely rough and so roundabout that a round trip by car is about 50 miles. In fact, pumpers used to spend about 2 hours a day making the trip to Thompsonville, gaging the tanks, switching them, and returning.

To prevent this waste of the pumper's time, The Texas Co. has installed automatic switching on the Thompsonville tanks. It has also installed a radio link to enable the pumpers to gage the tanks from a point in West Jennings field 9 miles away. This radio link cost only about one-third as much as a conventional pole-and-wire system would have.

The Texas Co. has also put in automatic switching and remote gaging on all four batteries in West Jennings field itself.

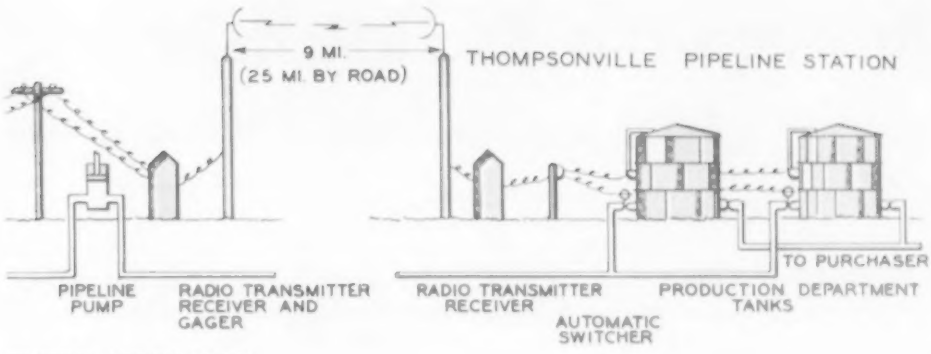
As a result of the new system, the pumpers' time is more productive and car expense is less.

Two base stations . . . The radio system is made up of two conventional base stations, both with receiver and transmitter operating in the 72-megacycle band. The equipment at both ends is full duplex; that is, each may receive and transmit simultaneously.

To transmit gages remotely, the Shand & Jurs equipment uses direct-current pulses. Ordinarily these signals are sent over wires to the remote reading point. But in getting these signals onto radio, it is necessary to convert

CONTROL POINT receives radio signals from West Jennings as well as signals over wire from four other batteries. Fig. 2. Inside the house pulses are converted to . . .

. . . TANK GAGES in feet and inches. The system saves much time and labor. Fig. 3.



RADIO SIGNALS span the distance of 9 miles to transmit the tank gages. With remote-reading gages, automatic tank switches and pipeline switches shown at left, pumpers save much time and expense. Fig. 1.

Save Pumper Rough 50-Mile Trip

them into audio-frequency tones. Then the tones are transmitted over the air to the receiving point where they are reconverted into d.c. pulses. And these pulses are fed into the remote gage just like any signals sent over a wire.

Operation of the radio-link gages is automatic and on the same "question and answer" basis as conventional remote-reading equipment. The operator at the control point closes a switch that "asks" the gage from a particular remote tank. Automatically the query is relayed to the selected tank, and the gage reading is automatically fed back to the operator. Once the answer is back, the equipment cuts off and resets itself in preparation for the next "question." It is necessary that each of the base radio stations have two antennas, one for transmitting and one for receiving. Due to the closeness of the frequencies used by the two stations, the antennas are spaced 50 ft. apart on the ground. Moreover, one is polarized horizontally and the other vertically. The antennas are mounted on wood poles.

To improve communication between Texaco personnel and the operators of the Thompsonville pump station, the radio equipment is being modified to include a voice channel. With this, the pipeline men can report to The Texas Co. on anything affecting its tanks or other equipment at Thompsonville. And The Texas Co. can notify the pipeliners of any production change that will affect their operations.

Centralized control . . . Figs. 2 and 3 show the control point from which The Texas Co. pumpers take all gages. Signals from the four batteries in the field come in over wires and radio brings the signals from the Thompsonville tanks.

Switching of tanks in the lease batteries is automatic and Fig. 4 shows the control box at one of them. The switcher has safety devices that prevent turning oil into a tank that is already full or on pipeline run.

Well testing at West Jennings is manual, but does not represent too much of the pumpers' time. Since the pumper has to visit each battery daily for other reasons, he can easily take test gages and samples at the same time.

The Texas Co. is using hydraulically operated bottom-hole pumps for artificial lift and this fact helps further in centralizing control. Fig. 5 shows a manifold for power-oil lines at one of the batteries. The power-oil pump is electrically driven.

SWITCHING of tanks is controlled by this automatic tank selector. Fig. 4.

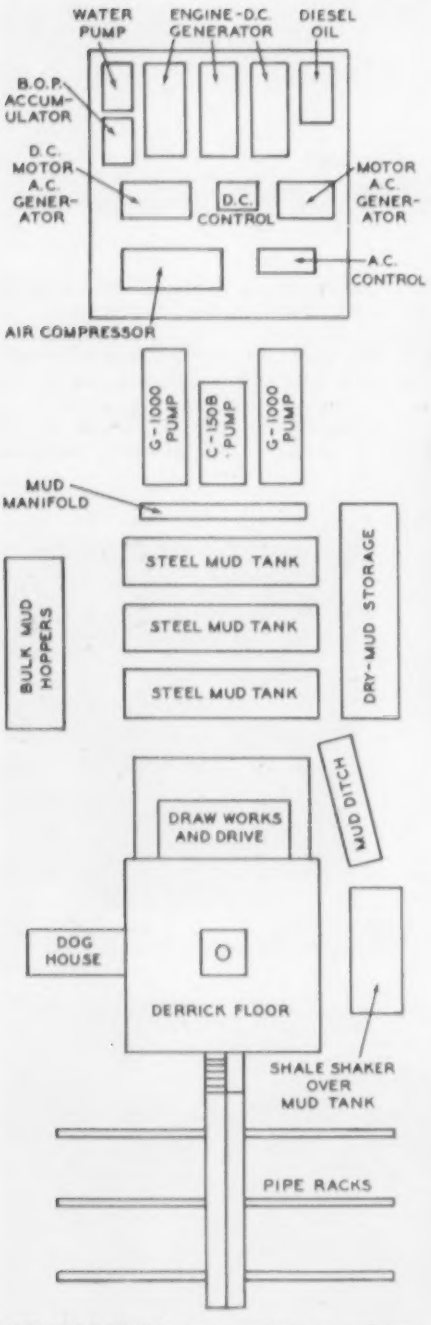
BOTTOM-HOLE HYDRAULIC PUMPS aid pumpers in centralizing control of batteries. Each gage and set of valves at this header represent a well being lifted with hydraulic power oil supplied by the single pump in the background. Fig. 5.

Shell's BIG One Drills Its First Hole

. . . where 9 5-8 in. protective string is 14,000 ft. long

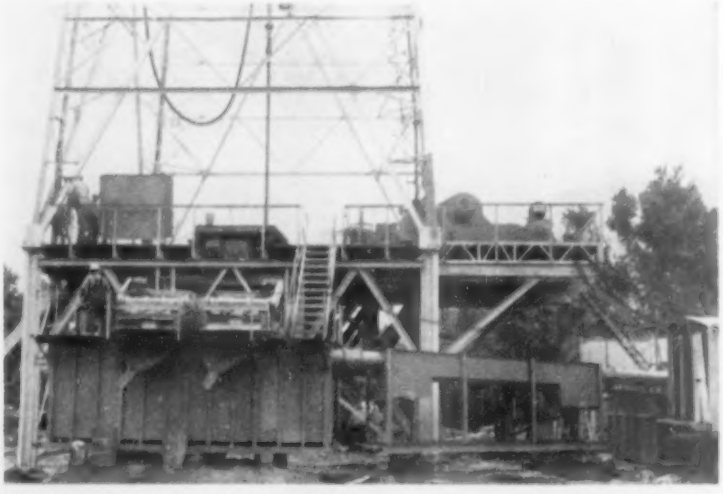
by Ed McGhee

Deep drilling in South Louisiana, both onshore and off, calls for gigantic rigs. In the Cote Blanche Island field, for example, where production is beneath the overhang of the salt dome, so much salt is drilled that a 9⅝-in. protective string through it will be as long as 14,000 ft. It takes big pumps to drill the hole and a lot of hoisting power to handle the pipe. This is the case of the first well drilled by Shell's big new diesel-electric rig. This article tells how Shell has arranged its Rig 11 for that service.



BIG RIG LAYOUT shows emphasis on mud pumps and power. Main d.c. generation equipment totals 2,625 hp. Fig. 1.

DRILLER'S CONTROL over equipment is centered in the panel next to the big draw works. He can read rotary torque and speed, pump speed, and speeds of all engines without leaving his position. Fig. 2.



ELECTRIC-POWERED DRAW WORKS rests on cantilever support off the substructure. Double shaker sits right on the first mud tank. Note steel mud ditch which helps trap solids carried over from tank. Fig. 3.

ONE of the most-powerful new rigs on the Gulf Coast is Shell Oil Co.'s Rig 11. It has these nine 625-hp. d.c. motors driving rig equipment.

Two driving each of two 1,200-hp. mud pumps

Two driving the draw works

One driving a mud-mixing pump

One driving the rotary

One driving an a.c. generator.

Besides this 5,625-hp. in d.c. motors, there is almost 200 hp. in a.c. motors driving auxiliary equipment.

Supplying the direct-current power are three GM 875-hp. diesel-engine generator sets. Also, there is a diesel-engine-driven 200-kw. a.c. generator for standby and for getting up power on new locations.

Because of the flexibility of operation and equipment placement, Shell expects to be able to put the rig onto a drilling barge or platform with few major changes if the need arises. Fig. 1 shows how Rig 11 was arranged for drilling its first well on Cote Blanche Island. Since the draw works is mounted on a cantilever support off the substructure, the mud tanks could be moved up against the substructure for barge or platform drilling. Also, to make placement on a barge easier, the accessory units are all skid mounted and self-contained.

Best in control, too . . . Another outstanding feature of Rig 11 is the available control the driller has over his equipment. Fig. 2 shows how compact the console is in spite of its completeness. Besides the usual indicators and controls, the driller also has indicators to show rotary torque, rotary speed, speed of all three pumps, and speed of all three engines.

On mechanical-drive rigs, devices to show rotary torque have not been too successful. With electric drive, the problem is easier. Shell has combined conventional measuring devices to get an accurate, dependable torque indicator, calibrated in foot-pounds. Knowing rotary torque, the driller gets a better idea of drilling conditions at any particular time.

The other indicators are equally useful and should save rig time as well as guard against trouble.

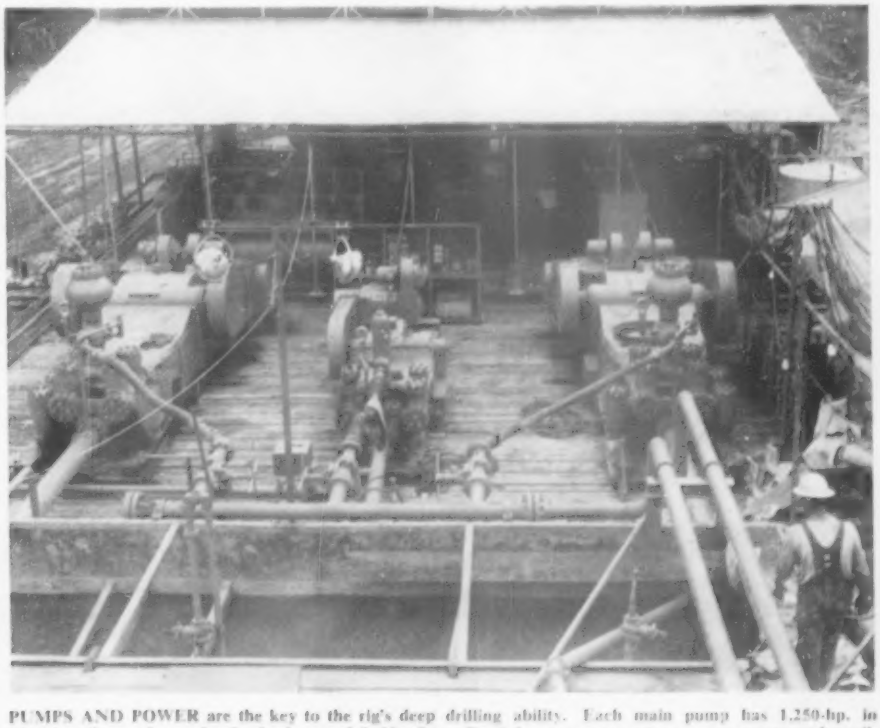
Besides the above indicators, the driller's console also has controls to run each of the big engines at idle, medium, or full speed. Lights on the panel show overload on the engines. Moreover, there is an emergency shutdown for all engines. There is also a seven-position selector switch which applies the various generators to the particular motors needed at a given moment. Thus, no generator is tied to one certain load but can be put wherever needed.

Control on series winding . . . On other rigs, drillers have reported trouble with series-wound electric motors powering drilling equipment. They say that the motors run away under no load, breaking chains in the drive. Apparently, the series-wound motor itself is not always at fault; they usually have controls to shut off power when speed rises over design r.p.m. But no driller likes to lose power on a motor at a crucial moment.

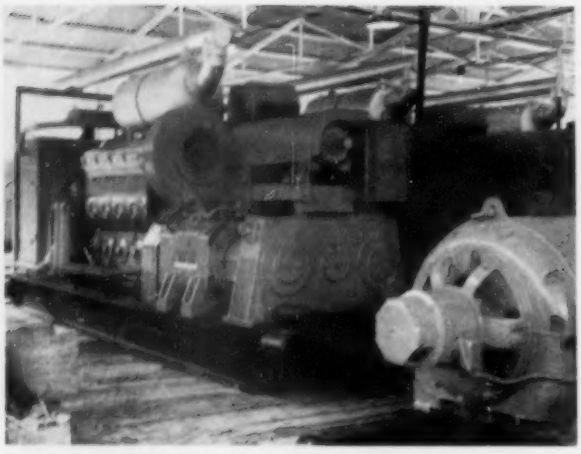
Since most controls are adjustable, the natural tendency is to keep raising the speed control each time the motor loses power because of excess speed. Finally, the control is set so high that the motor runs fast enough under no load to contribute to chain breakage. Then the series winding is blamed for the trouble. This is undesirable because series winding has excellent speed-torque characteristics for drilling service.

Realizing this difficulty, Shell has taken steps to get around it. The best idea would be to keep the motor from overspeeding in the first place, rather than simply shutting off power after it has already passed design speed. To do this, Shell has kept the series motor but added new controls to it; these actually regulate speed by regulating the generator-field excitation. The control is set so that no motor runs faster than 1,040 r.p.m. regardless of the load. Thus, the sprockets in all drives are selected so that 1,040 r.p.m. top speed

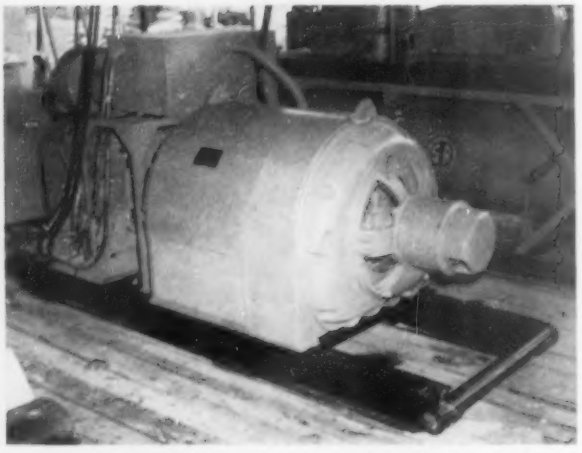
DERRICK is modified to 147 ft. from an original 189 ft., for platform drilling. Fig. 4.



PUMPS AND POWER are the key to the rig's deep drilling ability. Each main pump has 1,250-hp. in its drive. Power house in the background holds three diesel-d.c. generator sets, a.c. generators and auxiliary equipment. Fig. 5.



DIESEL-GENERATOR skids consist of one engine driving two generators. Three operating speeds are available and 875 hp. can be generated at top speed. Fig. 6.

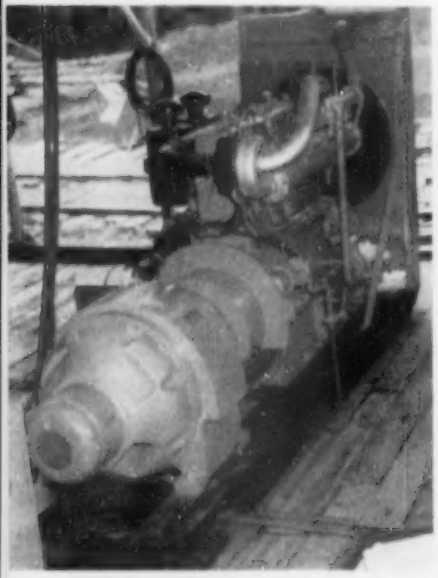


A.C. GENERATOR powers rig auxiliaries. This generator is driven by one of the d.c. motors of the same type that powers the drilling equipment. Power is 440 kw. Fig. 7.

will drive all equipjment at rated and designed r.p.m.

For added safety, Shell has kept the conventional power shutoff control, but has set it to shut off at a higher speed than the regulated speed. Then, if the speed regulator fails, the conventional control will keep the motor from running away.

Torque is controlled too . . . Besides the speed regulator, each motor also has a torque-limit control. These controls are a further safeguard against equipment breakage. On the rotary table, the torque-limit control has three different positions so that various sizes of drill pipe can be used with no danger of twisting off.



STANDBY A.C. POWER is provided by this 200-kw. generator and engine. This unit is used to start up power of the big engines on new locations. Fig. 8.

Double-drum draw works . . . Fig. 2 shows the National 130E Ideal draw works. It is fitted with an integral sand reel, Micro-Matic drilling control and 60-32 dynamatic brake. Control is through air-operated friction clutches. Supplying the power are two GM D-39M 625-hp. d.c. motors.

As a safety precaution, there is a torque-limit switch on the sand reel; this will prevent pulling the 9/16-in. sand line in two. Through special controls the draw works motors act as dynamic brakes to minimize coasting.

First hole drilled by Rig 11 is projected to 17,000 ft. and will require the setting of 14,000 ft. of 9⅝-in. protective string, a rugged test of the capabilities of this rig.

Fig. 3 shows the cantilever support for the draw works. On a barge or platform mounting, the steel mud tanks at right could be moved up closer to the substructure to conserve space.

The substructure itself is nominally 20-ft. This eight-post, four-truss substructure has enough vertical clearance that the blowout preventers do not have to be disassembled to be changed after setting casing, etc.

Derrick modified as four-well . . . Rig 11's derrick shows in Fig. 4. Originally, it was a standard 189-ft. derrick with a 37½ by 37½-ft. base and 1,100,000-lb. nominal capacity. However, as the picture shows, the upper section has been modified to provide a 147-ft. derrick. If used continuously on deep holes the derrick will be extended to a standard height of 189 ft.

The reason for this change goes back to the desire to make the rig adaptable for barge or platform drilling. With a few simple modifications, the derrick can be converted to drill at four different spots on the floor. The crown can be modified to be movable to four different positions also. Since the rotary is independently driven, it too can be made to operate at four different points. Thus, the derrick serves as a conventional unit on land but quickly becomes a multiple-well derrick for over-water operations.

Rig 11 has the usual rubber rotary hose. To take care of the high pressures that go with extremely deep drilling, there is also a steel hose permanently mounted in the derrick.

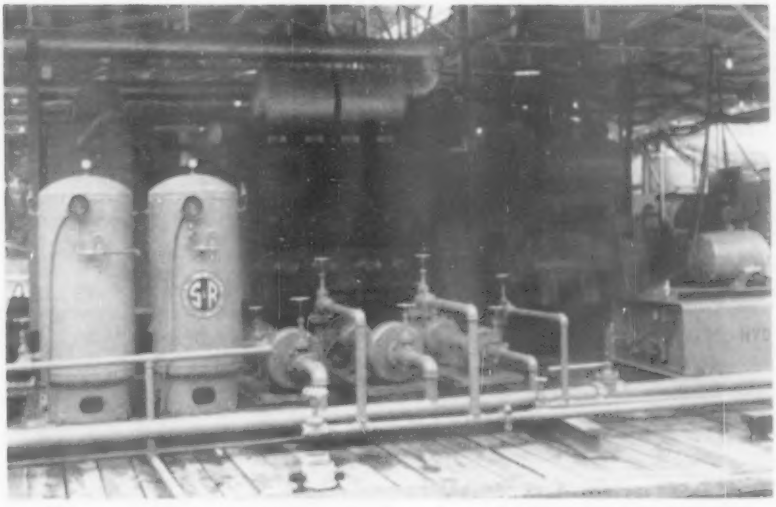
The crown and traveling blocks are rated at 500 to 450 tons respectively, and have 60-in. sheaves. The swivel is a N-1324 Ideal and the drilling line is 1⅜ in. in diameter.

The 625-hp. d.c. motor driving the 27½-in. Ideal rotary transmits its power through a shaft with two universal joints. This allows some misalignment that may be necessary in spotting the table. There is also an inertia brake on the rotary to stop it quickly when power is removed from the motor.

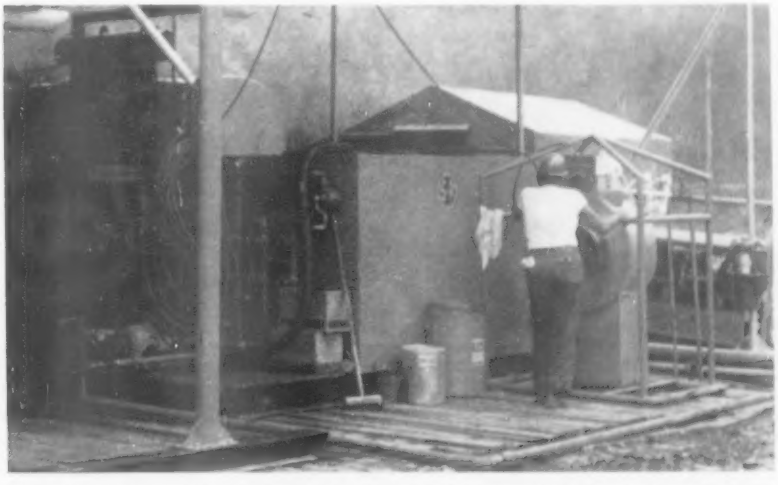
Big, high-pressure pumps . . . Fig. 5 shows the arrangement of Rig 11's three mud pumps. The larger ones are G-1000 Ideals, each driven by two 625-hp. d.c. motors. The small pump is a C-150B Ideal driven by a single 625-hp. motor and used for mud mixing.

Cote Blanche drilling calls for circulating great quantities of mud, often at high pressure.[1] For that reason, the circulating pumps have high-alloy fluid ends, hydrostatically tested to 8,000 psi. Also, the pumps are fitted with Hydril pulsation dampeners.

Drive for G-1,000 pumps is arranged so that one of the motors drives from either side. However, since the motors are connected in series, they operate together at all times. That is, one motor cannot run the pump by



WATER PUMPS in power house provide sanitary water, potable water, process water and washdown water. Pressure tanks are for the sanitary and potable supply. Fig. 9.



FUEL TANK is on skid with electrically powered fuel pump and standby hand-powered gear pump. It holds 1,200 gal. of diesel. Fig. 10.

itself without modification of electrical connections.

Although not shown in Fig. 5, the mud manifold is unitized and skid mounted.

Accessory Units

All of Rig. 11's accessory units are skid mounted and self-contained. As Fig. 1 shows, they are mounted under a roofed area on the first location. Following is a description of the various units.

Three diesels . . . Fig. 6 shows one of Rig 11's big 875-hp. diesel engines and the two generators it drives. The engines operate at 425 r.p.m. for low load, 675 r.p.m. for medium loads, and 835 r.p.m. under full load. The 875-rated hp. is at the highest speed.

The generators (two per engine) are interchangeable, and their armatures are interchangeable with those in the nine electric motors.

A.C. power supply. All rig auxiliaries are powered by a.c. motors. Fig. 7 shows Rig 11's motor-driven a.c. generator. This 400-kw., 440-volt, 3-phase generator is driven by the same type motor that powers the various drilling equipment.

The engine and generator in Fig. 8 are the standby a.c. source. This 200-kw. generator is used whenever the 400-kw. set is out of operation or on new location to get up power.

In the background of Fig. 7 is the compressed-air source. On the skid are two 5YC compressors driven by 10-hp. a.c. motors. There is also a 3YC compressor driven by a 30-hp. diesel engine. This manually started engine can furnish enough air pressure on new locations to start up the big diesel engines. Also on the same skid are compressed-air tanks.

Water and fuel . . . The unit shown in Fig. 9 pumps Rig 11's water supply. On this skid, there are five pumps. The five pumps are for sanitary water, potable water, process water, and washdown water. The sanitary and potable water pumps also have pressure tanks.

The operating fuel tank is shown in Fig. 10. The capacity of this tank is 1,200 gal. of diesel oil, or about 1½ days' supply for full-load operation. The skid carries an electrically powered fuel pump as well as a hand-operated gear pump for standby. Main-fuel reserve is stored in large tanks elsewhere on the location.

Control skids . . . Fig. 11 is the d.c. control skid for Rig. 11. Although the driller controls actual operation of the engines, and motors from the derrick floor, starters, and switch gear for this equipment are grouped onto this skid. Housing for it is weather tight. There is also a skid-mounted distribution panel for the a.c.-powered equipment.

Reference

1. Bell, Frank. "Shell Drills 12,410 Ft. of Solid Salt," The Oil and Gas Journal, page 127, September 19, 1955.

D.C. CONTROL equipment is housed in this box. A watertight seal protects the electrical starters and switches from the weather. Fig. 11.

Here are design formulas for a

New Pulsation Dampener for Piston Pumps

If you are having pulsation troubles with positive-displacement pumps, check the design formulas here. They result from a rigorous mathematical analysis based on electrical analogy and offer a method of designing a new type of dampener—one without gas-filled surge chambers.

by M. Ludwig

THIS article develops the necessary formulas for the design of a new type of pulsation dampener for use with high-speed reciprocating pumps. The novel feature of the design is that pulsations can be greatly reduced without the use of the usual, often troublesome, gas-filled chambers. For economic reasons, the design is generally limited to pumps operating at relatively high speeds.

At first thought, design of a pump pulsation dampener without the use of an air chamber of some form seems hopeless because of the virtual incompressibility of liquids such as petroleum and its derivatives. This skepticism was once shared by the patent examiners who reviewed the author's patent application,* even though pulsation dampeners of the design described had already been built and successfully operated. It therefore seems pertinent to show that, with proper design, the pulsating component of flow can be absorbed by compressibility of the pumped liquid contained in a chamber of reasonable size.

*Since granted as Patent No. 2727470, assigned to California Research Corp.

Author is engineer with Standard Oil Co. of California. Paper was presented at the seventh annual spring pipeline conference of the A.P.I., Houston, 1956, under the title of "Design of Pulsation Dampeners for High-Speed Reciprocating Pumps."

The curves of Fig. 1 show the approximate flow variation from a five-cylinder single-acting pump. The picture is idealized to the extent that each piston is assumed to follow a simple sinusoidal motion. No allowance is made for valve leakage, liquid compressibility, or other factors that always make the volumetric efficiency of the pump less than 100 per cent.

The effect of a volumetric efficiency of 97 per cent, for example, can be roughly treated as a series of flow pulses, each having a magnitude equal to 3 per cent of the volume of one cylinder. The pulse frequency is equal to the pump-stroke frequency. Lower-frequency components are possible if the behavior of all cylinders is not identical. For example, a reduced volumetric efficiency for a single cylinder will generate a pulsating flow with a fundamental frequency equal to the pump rotative speed. It is essential that such possible abnormal conditions be considered in pulsation-dampener design. Nevertheless, it is of interest to consider the flow variation for the idealized case of Fig. 1.

Each cylinder acts as a half-wave rectifier so the mean flow rate from each single-acting cylinder is $1/\pi$ times the peak flow rate, and the mean flow rate from five cylinders is $5/\pi$ (or 1.59155) times the peak flow rate from one cylinder. By reference to Fig. 1 and a table of trigonometric functions, it can be shown that the peak instantaneous flow rate is 1.66 per cent above the mean rate, and the minimum rate is 3.31 per cent below the mean rate.

Of more interest for the present purpose is the actual volume excess or deficiency while the flow rate is above or below the mean. A mathematical integration yields the result that the excess, or deficiency, is only 0.00320 times the volume of one cylinder.

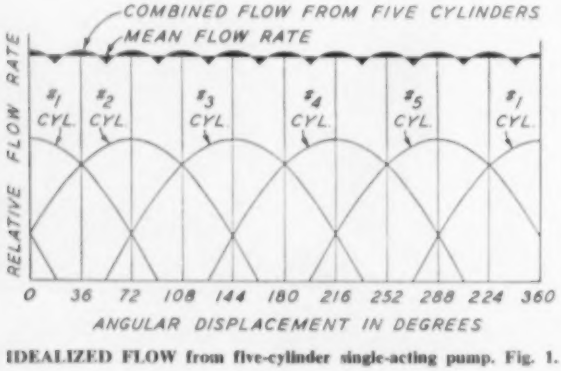
This idealized volume excess, or deficiency, is about one-tenth the approximate volume deficiency for an actual pump with a volumetric efficiency of 97 per cent. Also note that, for the idealized case, there are 10 flow pulses per revolution. For an actual pump with less than 100 per cent volumetric efficiency there will be five major flow pulses per revolution. Thus, a pulsation dampener for a five-cylinder single-acting pump should be designed for a fundamental frequency of five cycles per revolution.

Pressure rise due to pulse . . . Now, consider the pressure rise in a liquid-filled surge chamber that must absorb a sudden flow pulse. Assume that the pump has five 4-in.-diameter plungers with a 4-in. stroke. The displacement per stroke is 50 cu. in., and 3 per cent of this is 1.5 cu. in. Take the volume of the surge chamber as 10 cu. ft., or 17,280 cu. in. The bulk modulus of elasticity is around 180,000 psi., but the effective modulus may be taken as around 150,000 psi. to include an allowance for the elasticity of the steel chamber itself. The pressure rise in the chamber for a sudden flow pulse of 1.5 cu. in. would then be:

$$\frac{1.5 \times 150{,}000}{17{,}280} = 13 \text{ psi.}$$

This would normally be tolerable at the pump discharge, or suction. But it might be highly objectionable if allowed to travel into the discharge or suction piping where it could cause objectionable pipe vibration.

The next requirement for a complete



IDEALIZED FLOW from five-cylinder single-acting pump. Fig. 1.

pulsation dampener is, therefore, an element that will keep the pulsations within the liquid-filled chamber. This is the "choke" tube—a descriptive term for a length of pipe of relatively small diameter that carries the flow from the surge chamber to the main station discharge header.

Mathematical Analysis of Dampener

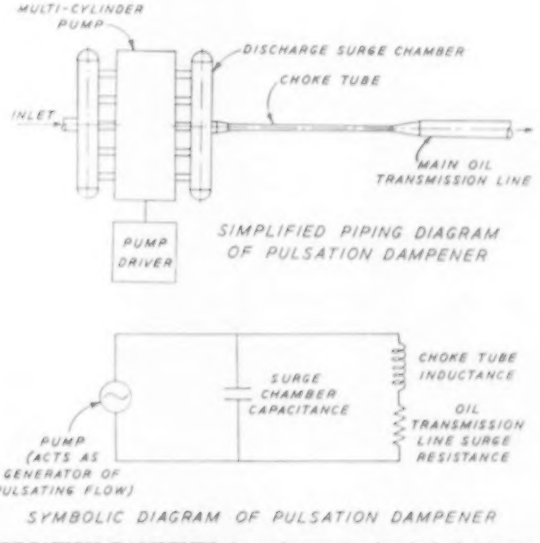
The mathematical analysis of a pump pulsation dampener is analogous to that of an electrical filter in which a condenser is equivalent to the surge chamber and an inductance is equivalent to the choke tube. The characteristics of the system beyond the choke tube must also be considered.

A simple, and not uncommon, case is that of a pump discharging directly into a long oil-transmission line. The change of pressure in a particular line is directly proportional to the change of flow rate and, by analogy with the long electrical transmission line, the constant of proportionability may be defined as the characteristic, or surge, impedance of the line. The surge impedance for the pipeline is a pure resistance since the flow and pressure changes are in phase. Attenuation of pulsations in a crosscountry oil line is normally great enough to prevent reflections from the distant end.

A diagram of a simple pulsation dampener on a pump discharging directly into a long oil-transmission line is shown in Fig. 2. Also shown is a symbolic diagram on which the symbols for the equivalent electrical components are utilized. The pump may be regarded as a constant-current generator. This current includes a steady component and a pulsating component. The steady component is of interest only insofar as its magnitude controls the minimum permissible size of the choke tube.

The notation to be used is as follows:

- a = velocity of pressure surge, ft. per sec.
- e = voltage of equivalent electrical circuit.
- f = frequency of pulsation, cycles per sec.
- g = gravity constant = 32.2.
- h = pipe wall thickness, ft.
- i = current in equivalent electrical circuit.
- j = complex operator = $(-1)^{1/2}$
- k = bulk modulus of liquid, lb. per sq. ft.
- k' = effective bulk modulus, lb. per sq. ft.
- p = pressure, lb. per sq. ft.
- q = flow rate, cu. ft. per sec.
- t = time, sec.
- y = length of choke tube, ft.
- ν = Poisson's ratio.
- ρ = fluid density, pound-mass per cu. ft.
- $\omega = 2\pi f$.
- A = cross-sectional area of pipe, sq. ft.
- B = cross-sectional area of choke tube, sq. ft.
- C = capacitance of surge chamber, $ft.^5$ per lb.-force.
- D = pipe diameter, ft.
- E = modulus of elasticity of steel in pipe wall, lb. per sq. ft.
- L = inductance of choke tube, lb.-force per $sec.^2$ per $ft.^5$
- R = pipe resistance, lb.-force per $sec.^2$ per $ft.^5$
- R_s = surge resistance of pipeline, lb.-force per $sec.^2$ per $ft.^5$
- V = volume of surge chamber, cu. ft.
- P = peak pulsating pressure of given frequency, lb. per sq. ft.
- P_0 = peak pulsating pressure without surge chamber and choke tube, lb. per sq. ft.
- P_p = peak pulsating pressure at pump with surge chamber and choke tube, lb. per sq. ft.
- P_L = peak pulsating pressure at line with surge chamber and choke tube, lb. per sq. ft.
- Q = peak pulsating flow rate of given frequency, cu. ft. per sec.



PULSATION DAMPENER is analogous to electrical circuit containing capacitance, inductance, and resistance. Fig. 2.

Development of Analogy

First, develop expressions for the capacitance of a surge chamber and the inductance of a choke tube. For the surge chamber, note that:

$$dp/dt = (k'/V)\,q \qquad (1)$$

if fluid is flowing into the chamber at the rate q. The equivalent equation for an electrical condenser is:

$$de/dt = i/C \qquad (2)$$

so, if pressure is analogous to voltage and flow rate is analogous to electrical current, the surge chamber capacitance is:

$$C = V/k' \qquad (3)$$

The equivalent inductance of a choke tube can be determined by application of Newton's second law which states that force is proportional to mass times acceleration. Thus, if frictional effects are neglected:

$$P = (\rho y/gB)\,(dq/dt) \qquad (4)$$

This relation assumes that the entire contents of the tube are accelerated simultaneously. A more involved, but easily derived, analysis is necessary if the time for the pressure pulse to travel the length of the tube is a substantial fraction of the period of the pulsating pressure. Equation 4 can be used if the length of the tube is small compared to the wave length of the pulsation. (The wave length is the distance between pressure peaks of a wave traveling through the pipe; it is equal to the velocity of the wave divided by the frequency of the pulsation.) Practically, Equation 4 may be used without correction if the tube length is less than one-eighth wave length. The equivalent equation for a lumped electrical inductance is:

$$e = L\,(di/dt) \qquad (5)$$

Thus, the inductance of a choke is:

$$L = \rho y/gB \qquad (6)$$

Surge resistance . . . The expression for the surge resistance of a long oil-trans-

mission line may be obtained directly from the water-hammer equation:

$$p = (\rho a/gA)\, q \text{ or}$$

$$p = [1/A\ (k'\rho/g)^{1/2}]\, q \qquad (7)$$

since the wave velocity in a pipeline is:

$$a = (k'g/\rho)^{1/2} \qquad (8)$$

The surge resistance is then:

$$R_o = \rho a/gA \text{ or}$$

$$R_o = 1/A\ (k'\rho/g)^{1/2} \qquad (9)$$

The effective bulk modulus, k', is slightly less than the bulk modulus of the liquid in a long pipeline because of the stretch of the pipe wall. Its value for a pipeline restrained against longitudinal movement is:

$$k' = \frac{k}{1 + (kD/Eh)\ (1 - \nu^2)} \qquad (10)$$

Its value for a surge chamber, which is not restrained against longitudinal movement is:

$$k' = \frac{k}{1 + (kD/Eh)\ (1.25 - \nu)} \qquad (11)$$

Problem is now electrical . . . The expressions for numerical calculation of the capacitance, inductance, and resistance of the pulsation dampener of Fig. 2 have now been established, and one can proceed with its analysis in the same way as for an analogous electrical filter designed to reduce alternating current components in a direct current system. The relations between pulsating flow and pressure for the three circuit elements are:

For a resistance:

$$P = RQ \qquad (12a)$$

For an inductance:

$$P = j\omega LQ \qquad (12b)$$

For a capacitance:

$$Q = j\omega CP \qquad (12c)$$

The quantity, ωL, is defined as the inductive reactance and the quantity, $1/\omega C$ is the capacitive reactance. They have the same units as a resistance. The complex operator, j, indicates that the pulsating flow, Q, lags the pulsating pressure, P, by 90° in an inductance. For a capacitance, the pulsating pressure lags the pulsating flow by 90°. The total pulsating pressure across an inductance in series with the surge resistance of the line is:

$$P = (R_o + j\omega L)\, Q \qquad (13)$$

The total pulsating flow into the filter is the sum of the flow into the capacitance and the choke tube inductance which is in series with the surge resistance of the main pipeline. Thus:

$$\text{Total } Q = [j\omega C + (1/R_o + j\omega L)]P_p \qquad (14)$$

Solving for P_p:

$$P_p = \frac{Q\,(R_o + j\omega L)}{1 - \omega^2 LC + j\omega R_o C} \qquad (15)$$

Now, suppose the pump discharged directly into the line with no inductance and capacitance. Then:

$$P_o = R_o Q \qquad (16)$$

Thus, the ratio of pulsating pressure with a filter to that with no filter is:

$$P_p/P_o = \frac{1 + j\,(\omega L/R_o)}{1 - \omega^2 LC + j\omega R_o C} \qquad (17)$$

Similarly, the ratio of pulsating pressure at the start of the line with and without the filter is found to be:

$$P_L/P_o = \frac{1}{1 - \omega^2 LC + j\omega R_o C} \qquad (18)$$

One is normally interested only in the magnitudes of these vectors, which are:

$$P_p/P_o = [1 + (\omega L/R_o)^2]^{1/2}\, (P_L/P_o) \qquad (19)$$

$$\frac{P_L}{P_o} = \left[\frac{1}{(\omega^2 LC - 1)^2 + (\omega R_o C)^2}\right]^{1/2} \qquad (20a)$$

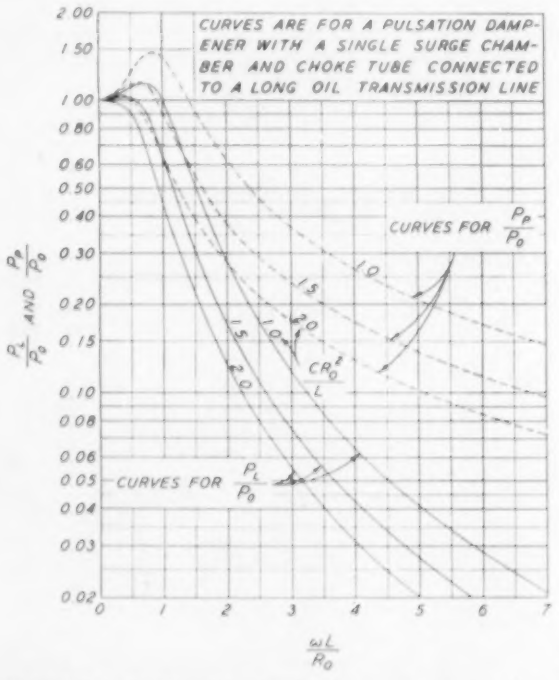
or, identically:

$$\frac{P_L}{P_o} = \left(\frac{1}{[(\omega L/R_o)^2\,(CR_o^2/L) - 1]^2 + (\omega L/R_o)^2\,(CR_o/L)^2}\right)^{1/2} \qquad (20b)$$

The value of pulsating pressure at the start of the line is of greatest interest. The pulsating pressure at the pump discharge is greater, but this occurs in a short, heavy, and rigidly supported surge chamber that is not free to vibrate. The pulsating pressure at the pump suction can, however, be important for pumps with a low mean suction pressure.

The curves of Fig. 3 illustrate the effect of frequency on the performance of pulsation dampeners with several different values of the parameter CR_o^2/L. This parameter is, for practical purposes, a function only of the system dimensions. It reduces to:

$$CR_o^2/L = VB/A^2y \qquad (21)$$



PRESSURE REDUCTION RATIOS for pump pulsation dampener. Fig. 3.

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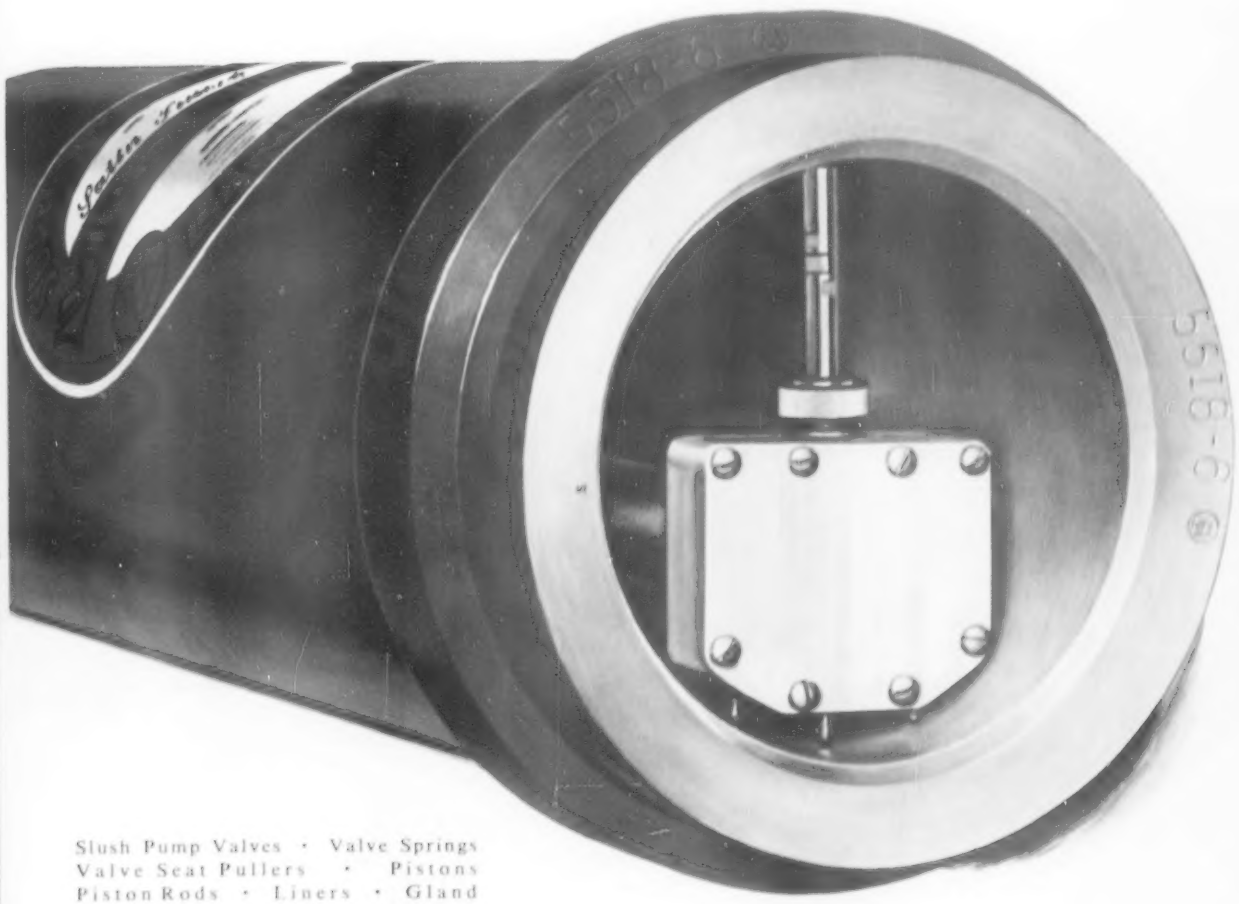

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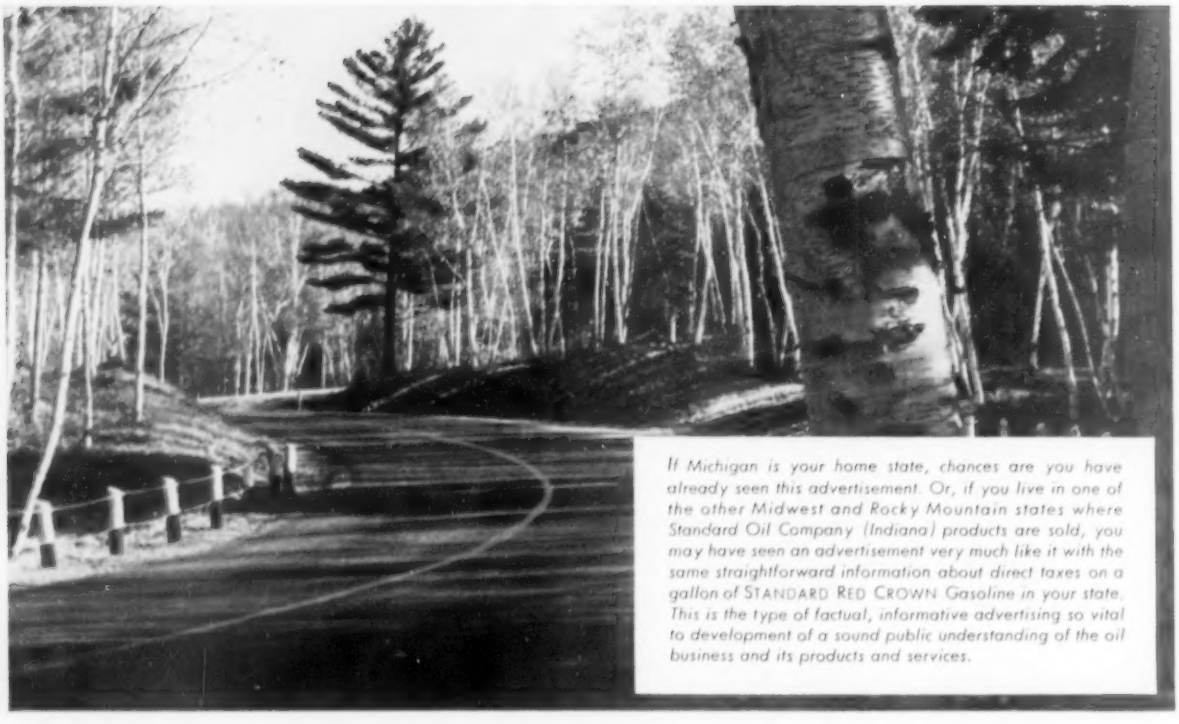

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Getting your money's worth? We think so. Look at it this way. A gallon of STANDARD RED CROWN Gasoline in mid-Michigan areas, for example, typically costs you 24 1/10 cents—excluding direct taxes, of course. For that, we find oil, transport it hundreds of miles, refine it to the finest quality gasolines you can buy for your car, and deliver it to your independent Standard Dealer. And your dealer's mark-up, which must cover his costs and what he earns for serving you, is included in the same 24 1/10 cents. Pretty reasonable, isn't it?

Then add your 6-cent state gasoline tax. Your state uses this tax, all of it, for maintaining and building better, safer highways.

Uncle Sam adds 3 cents more. That's the current federal tax on gasoline in all states. Under the new Federal Highway Bill, the federal government will be spending all this money on highways, too.

Finally your state sales tax amounts to more than 8/10 of a cent per gallon. This money helps support general governmental services, state and local.

These direct taxes you pay on gasoline total more than 9 8/10 cents a gallon

Remember, every time you pay the gasoline tax most of your money is buying better, safer roads in Michigan. And the next time you fill up at your Standard Dealer's you're getting one of the best bargains of any commodity you buy today—the highest quality, most powerful RED CROWN Gasoline we've ever made for only 24 1/10 cents per gallon, excluding taxes.

STANDARD OIL COMPANY (INDIANA)

STANDARD

if k' is the same for the surge chamber as for the pipeline. It appears that CR_o^2/L should be greater than unity if substantial amplification at low frequencies is to be avoided. Forcing frequencies below the normal design range may occasionally occur because of operation at reduced speed or because of unbalanced performance of the various pump cylinders.

Design of Simple Pulsation Dampener

Next, as an illustrative example, check the design of a pulsation dampener for a 10-cylinder 360-r.p.m. pump discharging 26,000 bbl. per day of diesel oil into an 8-in. line. The pump has two horizontally opposed banks of five single-acting cylinders, so the theoretical pulsating flow characteristic is the same as for a double-acting five-cylinder pump which, in turn, is substantially the same as for a single-acting pump. The fundamental frequency of pulsating flow would be 10 cycles per second (c.p.s.) for an ideal pump with no valve leakage, etc. Actually, each side of the pump will generate 30 c.p.s. pulses but, with a symmetrical piping arrangement, the fundamental 30-c.p.s. component of these pulses will tend to cancel out at the point where the flow joins from each bank of five cylinders. Preliminary design calculations and physical limitations have led to a surge chamber volume of 16 cu. ft. This volume includes the header volume for each bank of five cylinders plus the volume of a large crossconnection. A 4-in.-diameter choke tube is connected at the midpoint of the crossconnection.

Other pertinent data are:

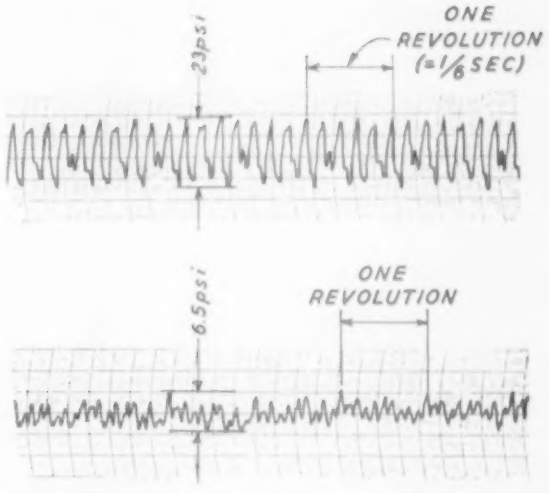
- $A = 0.347$ sq. ft. (flow area of 8-in. pipe).
- $B = 0.0885$ sq. ft. (flow area of choke tube).
- $k' = 150{,}000$ psi. $= 21{,}600{,}000$ lb. per sq. ft.
- $V = 16$ cu. ft. (surge chamber volume).
- $y = 8$ ft. (choke tube length).
- $\rho = 53$ lb. per cu. ft. (oil density).
- $q = 26{,}000$ bbl. per day $= 1.68$ cu. ft. per second.

From these data:

- $C = V/k' = 0.74 \times 10^{-6}$ ft.^{5} per lb. force.
- $L = \rho y/gB = 149$ lb.-force seconds^2 per ft.^{5}
- $a = (k'g/\rho)^{1/2} = 3{,}620$ ft. per second.
- $R_o = \rho a/gA = 17{,}200$ lb.-force seconds per ft.^{5}

$$\frac{CR_o^2}{L} = \frac{VB}{A^2y} = 1.47.$$

Values of other quantities at 30 and 60 c.p.s. are:



Oscillograph record at surge chamber on pump discharge.

Oscillograph record at outlet of choke tube on pump discharge. Note difference in pressure scale on oscillograph records. Records are for a 10-cylinder pump operating at 360 r.p.m.

PRESSURE PULSATION records for pump with pulsation dampener. Fig. 4.

	f	30 c.p.s.	60 c.p.s.
ωL		28,100	56,200
$\omega L/R_o$		1.63	3.27
$\omega^2 LC$		3.92	15.7
P_L/P_o*		0.378	0.0645
P_p/P_o†		0.723	0.220

*From Equation 20b or Fig. 3. †From Equation 19 or Fig. 3.

The mean flowing velocity in the 4-in. choke tube is 19 ft. per second and the calculated pressure loss, with due allowance for fittings, is 5 psi., well within acceptable limits.

The calculations indicate that this pulsation dampener should remove about 94 per cent of the 60-c.p.s. pulsations but only 62 per cent of the 30-c.p.s. pulsations. Actual performance records are shown in Fig. 4. The total pulsating pressure range was 23 psi. at the pump discharge and 6.5 psi. at the outlet of the choke tube. Unfortunately, no performance data are available for this pump, or a similar unit, with no pulsation dampener.

Note the prominent 30-c.p.s. pulsation at the pump discharge. Theoretically, as already mentioned, the 30-c.p.s. components from each side of the pump should cancel out. In this case, however, the pulsation record was taken at one of the two pump discharge headers and the distance between headers was sufficiently great that the cancellation did not occur at this point. A 60-c.p.s. pulsation is most prominent at the choke tube outlet, as would be expected.

Choke Tube Resistance and Parallel Operation of Pumps

So far, only the effect of fluid inertia, or inductive reactance, in the choke tube has been considered, but a resistive term must also be included for a complete analysis of the pulsation dampener. This resistance is generally small and, for a simple filter of the type which has just been analyzed, may either be neglected or added directly to the surge resistance of the line to which the choke tube is connected. At this point the analogy between fluid flow and flow of electrical current breaks down to some extent, since the pressure drop for turbulent fluid flow is substantially proportional to the square of the flow rate, whereas the voltage across an electrical resistance is directly proportional to the current. In the choke tube, however, the flow variation is only a small fraction of the total flow so one may use a "dynamic" resistance defined as:

$$R = dp/dq \qquad (22a)$$

Then, if p is proportional to the square of q:

$$R = 2\,(p/q) \qquad (22b)$$

in which p is the total pressure drop across the choke tube for the mean flow, q. For the 4-in. choke tube of the illustrative example:

$$R = 2\,(5 \times 144/1.68) = 860 \text{ lb.-force seconds per ft.}^5$$

This is small compared to a figure of 17,200 for the surge resistance of the 8-in. line, and may ordinarily be neglected. Resistance values so calculated have been used in the attenuation equation for long transmission lines with results that check quite well with actual measured attenuation of pulsations along an oil pipeline.

An interesting case for which the choke tube resistance may become important is that of parallel operation of two pumps each of which is equipped with pulsation dampeners of the type already described. Assume that the two pumps are alike and are operated at substantially the same speed. Then the net line pulsations at any particular frequency may add or cancel, depending on the phase relation between the two pumps. Thus, the effective surge resistance of the line, as viewed from either pump, can vary all the way from twice the actual surge resistance to zero. The case of zero surge resistance is particularly important because the choke tube resistance is then the only resistance left to limit the magnitude of pump pulsating pressure if the pump should generate a pulsating flow of the resonant frequency of the surge chamber-choke tube combination. This condition occurs when:

$$\omega^2 LC = 1 \qquad (23)$$

and, from Equation 15, the magnitude of the pump pulsating pressure for the resonant condition becomes:

$$P_p = \omega L\ (\omega L/R)\ [1+(R/\omega L)^2]^{1/2}\ Q \qquad (24)$$

The pulsation dampener of the illustrative example is resonant at a frequency of 15.1 c.p.s. at which frequency L = 14,200 and $\omega L/R = 16.5$ so that $P_p = 234{,}000\ Q$. For a peak pulsating flow at this frequency equal to 2 per cent of the average flow of 1.68 cu. ft. per second, $P_p = 7{,}860$ lb. per sq. ft. = 55 psi. Actually, this pump could not generate a pulsating flow frequency of 15.1 c.p.s. unless it were operated at approximately half normal speed.

This writer has encountered one actual case of resonant pulsations with two four-cylinder pumps operating in parallel. The pumps generated a relatively weak first order pulsation in addition to the major fourth order pulsation and, as it turned out, the surge-chamber-choke-tube combination was close to resonance for this first order pulsation. The pumps were driven by induction motors which operated with a very slight speed difference so that the line pulsations alternately added and canceled over a period of about 6 minutes, as indicated by a measured periodic variation of the pump pulsating pressure from 18 to 160 psi. This large variation in first order pulsating pressure at the pump caused no apparent change in mechanical vibration, probably because the pulsation was contained in a relatively short surge chamber throughout which the instantaneous pressure was uniform. The pulsation dampeners did an effective job of reducing pulsations in the connected piping.

Possible Variations in Pulsation Dampener Design

Many variations of the simple pulsation dampener, which has been described, are possible. For example, a surge chamber can be connected to the pump suction or discharge header through a short branch line. Proper sizing of the branch connection will make this system resonant at any desired frequency and greatly increase the effectiveness of the surge chamber for that frequency. This system can be particularly effective if a resonant branch chamber is used in conjunction with a through-flow chamber. The resonant chamber can then be tuned to the lowest pulsation frequency component so that the through-flow chamber need be designed to remove only the higher harmonics. The tuning cannot be exact because of possible variations in liquid compressibility and pump speed, but actual analysis does show that a tuned vibration absorber can be economically advantageous even for variable-speed operation, especially for pumps operating at relatively low speeds. Such a design has actually been used on a five-cylinder pump designed to operate from 100 to 150 r.p.m.

A variant of the tuned surge chamber is a closed branch pipe designed to have a length of quarter wave length at the frequency to be absorbed. Such a branch line will develop a very high pulsating pressure at the closed end and a low pulsating pressure at the open end where it is connected to the pump suction or discharge. It will also absorb odd harmonics of the design frequency. A possible disadvantage of the tuned branch line is that mechanical vibration can result from the instantaneous difference of pressure at the two ends. Incidently, it is not necessary that the quarter-wave-length branch be physically straight, although a straight branch can be expected to be freer of mechanical vibration. Pressure pulsation forces could, of course, be balanced by use of two straight quarter-wave-length tubes extending in opposite directions. For the same reason, connections to a cylindrical surge chamber should preferably be made at the midpoint of the chamber.

BOOKS

WYOMING STRATIGRAPHY, PART 1: SUBSURFACE STRATIGRAPHY OF THE PRE-NIOBRARA FORMATIONS IN WYOMING. Published by Nomenclature Committee, Wyoming Geological Association, 1956. 98 pp., 8 subsurface correlation charts. Available from Wyoming Geological Association, Box 845, Casper, Wyo. Price: $8.

The eight subsurface correlation charts from along the flanks of all of Wyoming's basins consist of combined electrical and lithologic logs. These charts show the regional relationships of the principal stratigraphic units throughout the state. The charts are reduced and individually printed to a size (approximately 25 by 35 in.) that is easy to handle.

Accompanying the charts are 98 pages of text discussing and summarizing the statigraphy of each of the basins, emphasizing the petroleum potential, nomenclature, intraformational and interformational relationships, and a bibliography of important stratigraphic references.

The volume is in a ring-type permanent binder so that subsequent stratigraphic information can be added as it is published by the association. Although the volume deals primarily with stratigraphy, it will be very useful to all people of the oil industry in that it will define formation names and boundaries in all parts of the state. Not only will it help geologists to evaluate a given area as to lithologic and reservoir characteristics, but it should also help other professions in the oil industry to become acquainted with Wyoming stratigraphy.

CANADA LOOKS AHEAD. By Grace Laugharne. Published by The Royal Institute of International Affairs, 345 East Forty-sixth Street, New York 17. 158 pp. $2.25.

This digest of Canada's remarkable boom during the past decade should appeal both to those who are interested in the mineral resources and to businessmen who are concerned with Canada as a market or as a field for investment.

The rapid economic development of Canada during recent years has been quite outstanding. No other country can boast such progress. The way in which Canada has achieved these spectacular results is vividly described and analyzed by the author, herself a Canadian. She discusses in detail the chief projects which are still in the planning or construction stage.

New pipelines for oil and natural gas, further development of hydroelectric power, expansion of existing industries and establishment of new ones are just a few of the current developments discussed.

The author also deals briefly with major political issues, and shows how Canada has achieved political maturity and a growing prestige in world affairs.

SYMPOSIUM ON ATMOSPHERIC CORROSION OF NONFERROUS METALS. Published by A.S.T.M., 1916 Race Street, Philadelphia 3. 164 pp., heavy paper cover, $2.75.

This symposium covers one of the most comprehensive test programs for measurement of atmospheric corrosion properties of nonferrous metals and alloys ever attempted.

Exposure tests were started 27 years ago. Materials utilized included 24 wrought alloys of zinc, nickel, copper, lead, tin, and aluminum.

IMPORTANCE OF BIOLOGICAL RESEARCH IN INDUSTRIAL MEDICINE. Reprint from Journal of A.M.A. distributed by Industrial Hygiene Foundation, Mellon Institute, 4400 Fifth Avenue, Pittsburgh 13. 12 pp. No charge.

A report of laboratory tests made for symptoms, signs, organs, or systems affected and related to some commonly used toxic substances by various industries.

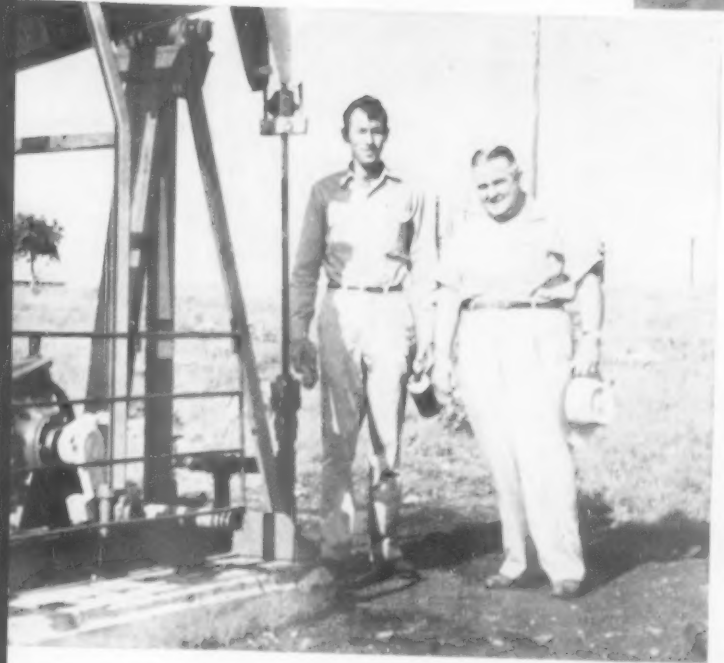
A brief review of the functions of a biological laboratory shows the significant contributions that can be made to industrial medicine.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P.O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

AXELSON PICTORIAL

SWAMPED. Curly Robin, Pumper for the California Company in the Plumb Bob Field, Lafayette district, Louisiana, gives the stuffing box a shot of grease on the St. Martin Land Company #1. An Axelson RL Plunger Pump ($2\frac{1}{2} \times 1\frac{3}{4} \times 15$) pumps 156 B/D of 37 gravity oil from 5,100 ft. Curly visits his swampland wells by boat.

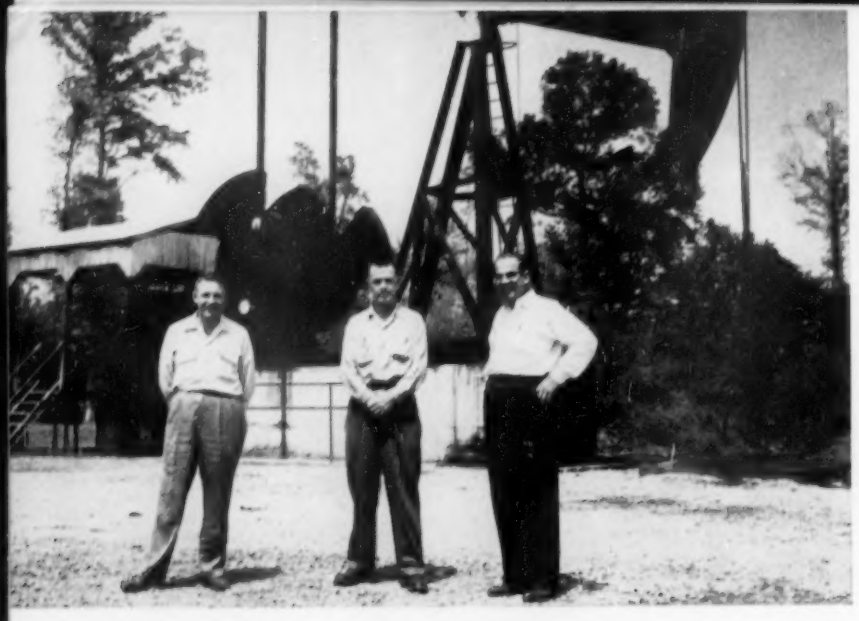
COSTS CUT. Don Williams (left), Pumper for Seneca Oil Company, and Jack Felton, Axelson Representative, beside the No. 23 Linn in the T.C.U. Field, Cook County, Texas. This well was pulled on an average of twice a month until an Axelson $1\frac{1}{4}$" Acme Pump with Duax Liners was installed September 1955. It has been running continuously ever since, 24 hours a day, and has not been touched. Seven other wells were converted to Axelson Acme Pumps and *pulling costs were cut from $475 to $75 per month.*



HEARTBEAT. Checking the pulse is Frank Roberts, Pumper for National Associated Petroleum Company, on one of the company's 60 pumping wells in the Whitetail Field, Osage County, Oklahoma. All of these wells are equipped with Axelson $1\frac{1}{2}$" Sure Seal Pumps and Axelson $\frac{5}{8}$" Rods, and pump from the Mississippi Lime at 2050 ft.

AXELSON

USS



THE DEEPEST. An Axelson 1¼" bore pump with hardened cast iron liners and 60" heavy chrome-plated stainless steel plunger, pumps 20 BPD of 38 gravity oil from 10,178 ft. This is the deepest pumping well in the Mallalieu Field, Brookhaven, Mississippi. A 3-step Axelson #59 sucker rod string actuates the pump. (l. to r.) Harold Long, J & L Store Manager, Brookhaven; Pat Moran, Production Foreman, The California Company (and Yogi Berra fan); Truman Reader, Axelson Representative.

GOOD RECORD. In front of Ashland Oil & Refining Company's #1 Crouch at Luther, Oklahoma, is Tom Charter, Pumper, and Charles Chandler, Chief Gauger. This well was completely Axelson equipped on July 1, 1955, with a Hydrax pumping unit, Axelson sucker rods and Axelson deepwell pump. It lifts sweet oil (39 gravity) from the Red Fork Sand at 5,062'. *To date no repairs have been necessary on any of the equipment.*

ON REQUEST. Axelson has a limited supply of "Factorules", a slide rule for calculating production, loads and other factors in pumping wells. It provides a quick means for estimating production and efficiency of wells produced by sub-surface reciprocating pumps and sucker rods. A Factorule complete with instructions will be mailed free of charge when requested on your company letterhead. Write to Dept. O.

NEW FIELD. B. L. Coggins, Production Foreman for McNeish & Grallap, looks after 28 producers on the Muller Lease in the Cleveland Sand Field, Kay County, Oklahoma. This is a relatively new field, first discovery was 1954. The 14 wells on the pump *(all equipped with Axelson rods and pumps)* produce from the Cleveland Sand at 3,150'. Pressure drop is rapid and it is expected the 14 flowing wells will soon go on pump, too. "When they do, they'll be outfitted with Axelson equipment. You can be sure of that!" B. L. states.

AXELSON PICTORIAL

OKLAHOMA'S FIRST. This is the Nellie Johnstone #1 located in the city park at Bartlesville, Oklahoma. Completed April 15, 1897, it was the *first commercial oil well* in Oklahoma. It produced until about 2 years ago from 1900 ft. and is now plugged. Reading the inscription is M. J. Bohnsack, Salesman at the Jones & Laughlin Store at Bartlesville. This was the *first supply store west of the Mississippi.* J. & L. is distributor for Axelson pumps and sucker rods in all oil producing areas east of California.

TWINS. Ray Postier, Production Pumper of P. G. Lake, Inc., set up this dual job on the Cogswell Heirs Well #2, Garfield County, Oklahoma. Axelson Pumps and Rods are pumping both pays; a $1\frac{1}{2}$" Axelson insert pump produces the Marshall sand at 6150' while an Axelson $1\frac{1}{4}$" Axelson pump produces the Meisner sand at 5950'. An Axelson two-step rod string composed of 45% $\frac{3}{4}$" rods and 55% $\frac{5}{8}$" rods is used with both pumps.

HARD WORKER. Operating at 6 strokes per minute, this Axelson Long Stroke Hydraulic Pumping Unit pumps from a 9,300 ft. depth in the Sarrah Burks Lease near Lindsay, Oklahoma for Magnolia Petroleum Company. These units are recommended where large volumes must be raised from great depths. The slow pumping rates increase the life of sucker rods and sub-surface pumps as high as 8 times their normal life expectancy. A $2\frac{1}{2}$ x $1\frac{1}{4}$ x 40 Axelson Rod Liner Pump is at bottom. W. T. Holman is the Pumper.

SMALL WONDER. This is one of 18 Axelson Hydrax pumping units specially designed for Union Oil Company to pump the low gravity crude (8.5 to 13) in the Guadalupe Field, California. A diluent is pumped down Axelson Hol-O-Rods and an Axelson TLE pump with Duax Liners lifts 65 B/D with 50% sand cut from 3,100 ft. (l to r) Bob Talley, District Foreman; Cliff Dunham, Assistant Production Foreman; Bob Smith, Production Foreman (all of Union Oil Company). Chuck Garner and Bob Quinn (Axelson).

AXELSON PICTORIAL

PUBLIC DEMONSTRATION. Harold F. Allen, Science Instructor at Coalinga College, California, uses a model of an Axelson RLA (rod-type) subsurface pump to explain the principle of artificial lift to his engineering students. Axelson gladly makes available these model oilwell pumps to schools and colleges for classroom study. A 15-minute demonstration will often save hours of classroom discussion and blackboard diagramming.

TUBING RUN. High on a hill overlooking the blue Pacific at Capitan, California, General Petroleum Corp's well service crew runs tubing back into the well while Hydro-Test runs a simultaneous check for tubing leaks. Equipped with an Axelson 2" RLB Pump and Axelson ¾" #59 Sucker Rods, this well makes 12 B/D of 28 gravity crude from 2,600 ft. (l. to r.) Edwin Bruce, June Garland, Burl Hankey (Gang Pusher), Cecil Sutton.

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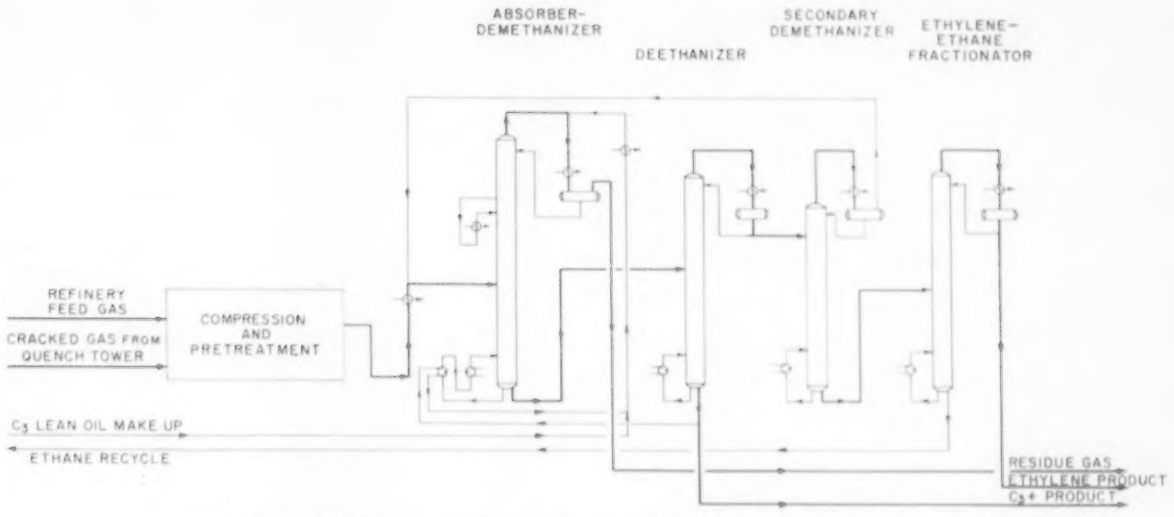
Where to buy Axelson Production Equipment:

CALIFORNIA: *Axelson stores at Bakersfield, Coalinga, Huntington Beach, Long Beach, Orcutt, Santa Fe Springs, Taft, Ventura; Hickey Pipe & Supply Co. (Sucker Rods)* • **MID-CONTINENT:** *Jones & Laughlin Steel Corporation, Supply Division (Headquarters, Tulsa)* **ROCKY MOUNTAINS:** *Jones & Laughlin Steel Corporation, Supply Division; Great Northern Tool & Supply Co., Billings, Montana* • **CANADA:** *Jones & Laughlin Steel Sales Co. Ltd., Calgary; Dominion Oilfield Supply Co. Ltd., Calgary* • **MEXICO, D. F.:** *Wells Fargo & Co. Express, S. A.* • **RIO DE JANEIRO, BRAZIL:** *MAQUIP (Commercial de Maquinas e Equipamentos) S. A.* • **LIMA PERU:** *Gross Equipment, S. A.* • **LA PAZ, BOLIVIA:** *Del Prado & Compania, Ltd.* • **BUENOS AIRES, ARGENTINA:** *Adrian Bolland & Cia., S. R. L.* • **BARCELONA, VENEZUELA:** *Servicios Industriales, C. A.* • **MARACAIBO, VENEZUELA:** *Servicios Industriales, C. A.* • **BOGATA, COLOMBIA:** *Servicios Industriales, C. A.* • **TRINIDAD, B. W. I.:** *Industrial Agencies, Ltd.*

Where to buy Axelson Hydraulic Pumping Units:

CALIFORNIA: *Axelson stores (see above)* • **ODESSA:** *Axelson Warehouse* • *Industrial Supply Company stores at* **DALLAS, ELECTRA, FORT WORTH, FREER, HOUSTON, KAMAY, MIDLAND, ODESSA, SAN ANTONIO, SNYDER, TULSA, TURNERTOWN, WICHITA FALLS** • *Mountain Iron & Supply Company stores and offices at* **ANTHONY, AUGUSTA, BARTLESVILLE, DENVER, GREAT BEND, INDEPENDENCE, KIMBALL, LEROY, MADISON, McPHERSON, PARKERSBURG, PLAINVILLE, RUSSELL, TULSA, WICHITA** • *Export (See above).*



ETHYLENE PURIFICATION UNIT, low-temperature absorption and fractionation type. Fig. 24.

MAKING ETHYLENE—6

More Methods of Recovering Ethylene

. . . from hydrocarbon mixtures

by H. C. Schutt* and S. B. Zdonik†

THE processes in general use and details of the low-temperature-fractionation and absorption-low-temperature-fraction methods for separation of ethylene from other hydrocarbons were covered in the last installment (*The Oil and Gas Journal, July 30, page 171*). Other methods of separation are discussed here.

Low-Temperature Absorption and Fractionation

Refrigerated absorption has been used for extracting ethylene and heavier constituents from the process or pyrolysis gas as a demethanization step, and subsequently recovering the desirable olefin products by fractionation. In earlier plant designs of this type, a light aromatic distillate cooled to 60°-70° F. has been used as absorption medium.[28]

More recent commercial designs use propane, butane, or pentane as absorbent with operating temperatures ranging from —10° to —40° F. and pressures in the order of 400-500 psia., depending on the molecular weight of the absorption medium. Fig. 24 illustrates the design of a plant of this type processing a pretreated and dried feed stream.

The absorber - demethanizer is the heart of the recovery system. It affects the operation of all of the subsequent equipment. If the methane content of the absorber-demethanizer bottoms is not carefully controlled, it may prove difficult to condense reflux in the deethanizer, secondary demethanizer, and ethylene-ethane fractionator at their specific design conditions.

When the absorber - demethanizer operates at a pressure of approximately 410 psia., with propane lean oil cooled to —30° F., the residue gas temperature from the top of the absorption section will be about —10° F. and the reboiler temperature about 85° F.

It is usually desirable to cool the feed to a temperature in the order of —30° F. to reduce the heat load in the bottom of the absorption section and the intercoolers. Consideration should also be given to the use of a condenser for the vapors from the stripping section, since this would also reduce the heat transferred to the absorption section.

Oil-intercooling balance . . . A balance must be made between lean-oil rate and intercooling. Operation of the absorber-demethanizer at the lowest permissible lean-oil circulation with a given number of trays entails the use of a large number of intercoolers. High lean-oil rates are undesirable in view of the following considerations:

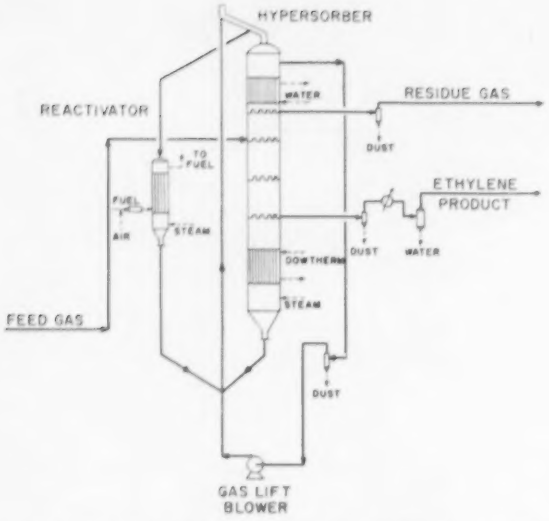
1. **Heat and cooling water requirements are increased** in proportion to the increase in lean-oil rate.

2. **Demethanization to a high degree is more difficult** because, for a specified methane content in the ethylene product, an increase in lean-oil rate requires stripping the absorber-demethanizer net bottoms to a very low methane mole fraction.

3. **Deethanization is more difficult** if the lean-oil rate is increased, because the mole fraction of ethane and lighter in the deethanizer feed is decreased, requiring corresponding higher reflux and reboil rates.

On the top few plates of the absorption section, the stripped lean oil becomes saturated with methane and requires that the heat of absorption be removed in an intercooler located a few plates from the top. It is usually advantageous to saturate the lean oil with methane contained in the residue gas after it leaves the top of the ab-

*Consulting engineer, 201 Devonshire, Boston; and †process engineer with Badger Process Division of Stone & Webster Engineering Corp., Boston.



HYPERSORPTION UNIT for recovery of ethylene from a lean-gas stream. Fig. 25.

sorber in a refrigerated overhead cooler and simultaneously removing the heat of absorption.

This operation provides more efficient utilization of the plates in the absorption section and reduces the lean-oil loss due to vaporization because the residue gas can be controlled to a close temperature approach to that of the refrigerant. If the absorber-demethanizer operates without the overhead cooler and at —10° F. top temperature, the propane lean-oil loss may be as high as 10 per cent of the circulation and means must be provided to reduce this loss to a reasonable figure.

Methods utilizing either a sponge oil system or refrigerated liquefaction have been used for recovering this lean oil.

Approximately 50 actual plates are normally required in the absorber-demethanizer. A plate-to-plate calculation is required to establish the final design, determine the lean-oil rate, and the specific location of the intercoolers.

Deethanizer . . . The rich oil from the base of the absorber-demethanizer flows to the demethanizer which operates at a pressure in the order of 325 psia. Reflux is condensed at 10° F. and reboil heat is supplied at the tower base at approximately 145° F. The separation between ethane and propane is not difficult and with 35 plates an operating reflux ratio of 1.7 is required.

A portion of the deethanizer bottoms is withdrawn continuously for recovery of the heavy ends and conditioning of the lean oil. The remainder of the deethanizer bottoms is combined with fresh lean oil and returned to the absorber-demethanizer as absorbent.

The net overhead from the deethanizer is pumped to the secondary demethanizer which operates at a pressure aproximately 20 psi. higher than the absorber-demethanizer. This permits recycling the net overhead to the absorber-demethanizer feed to maintain high ethylene recovery.

The reflux temperature is approximately —30° F. and the reboiler temperature 25° F. Twenty plates will suffice to reduce the methane content to less than 0.1 mole per cent in the ethylene product. Although the reflux ratio based on net overhead is high, the actual refrigeration requirement in the condenser is moderate.

Where the ethylene product does not have rigid methane specifications, this tower may not be necessary. The bottoms from the secondary demethanizer flow to an ethylene-ethane fractionator which operates in the same manner as described under "Low-Temperature Fractionation."

Adsorption

Adsorption, utilizing activated carbon in fixed beds, is an operation that has been used successfully in the past for recovering gasoline from natural gas and solvents from vent vapors. New processes utilizing this principle are based on improved methods of applying an old art to separating by selective adsorption a material which is present in a gas mixture in relatively small amounts from the more volatile constituents.

Hypersorption . . . Ethylene has been recovered from light hydrocarbon gases by adsorption. In 1947, Dow Chemical Co. installed a commercial unit to recover ethylene from demethanizer residue gas containing approximately 6 mole per cent ethylene.[26] The process used was licensed by Union Oil Co. under the name of Hypersorption and consisted mainly of an adsorption column or hypersorber with a top cooling section, a middle adsorption section, and a bottom stripping and heating section.

A carbon reactivator for maintaining carbon activity, a centrifugal blower for supplying lift gas to circulate the adsorbent, a Dowtherm system for supplying stripping heat, and equipment for removing carbon fines are other important accessory units included in the design. Fig. 25 represents a schematic sketch of a Hypersorption unit designed for the recovery of ethylene from a lean-gas stream.

Operating conditions . . . In this unit, the feed gas at 90 psia. passes directly to the adsorption section where it flows upward in contact with and countercurrent to the carbon descending from the cooling section at a temperature of 120° F. Continuous movement of the carbon down the column is accomplished with the aid of oscillating shaker trays.

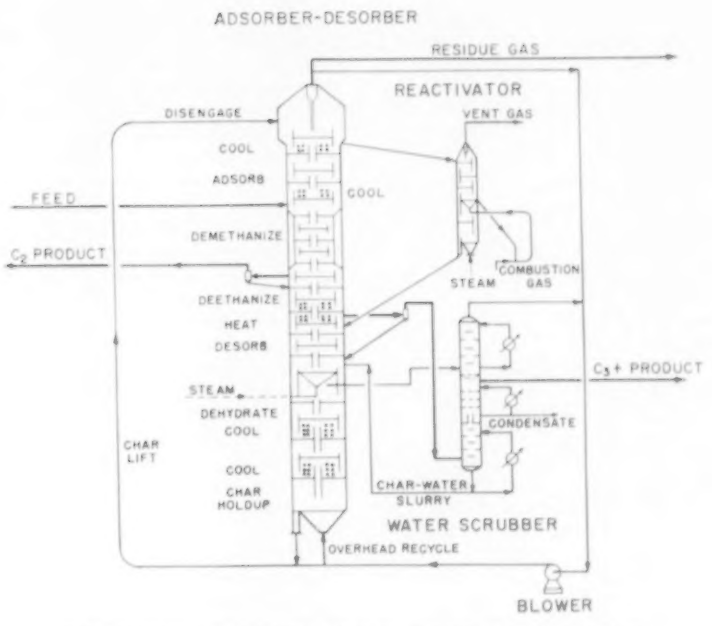
The carbon selectively adsorbs the ethylene and heavier constituents and the unadsorbed components leave the tower just below the cooling section and are discharged to the fuel system. The adsorption section operates at an average temperature of 140° F.

The components adsorbed on the carbon pass to the lower section where stripping is accomplished at an average temperature of 300° F. by heat supplied from a Dowtherm system. All of the stripped hydrocarbons are not removed from the column at the top of the stripping section. A portion is allowed to pass into the adsorption section as reflux to strip out any undesirable light components which would contaminate the product.

Below the stripping section a steaming zone operating at a maximum temperature of 500° F. is provided to desorb the last traces of adsorbed material. The carbon leaves the base of the column and is transported to the top by a gas-lift system. At the top of the column, the carbon is dehydrated and passed into the cooling zone for the next cycle.

Efficiency . . . It has been reported that the Dow unit has operated with an ethylene recovery of 98 per cent and is producing a product containing in excess of 92 per cent ethylene with only 0.1 per cent methane. Since the feed to this unit was closely fractionated with negligible quantities of constituents boiling above ethylene, it was found that the facilities provided for carbon reactivation were unnecessary.

It was possible to desorb the highest-



FLUID-CHAR ADSORPTION UNIT for recovery of ethylene. Fig. 26.

boiling material in the normal stripping operation and keep the carbon activity at a high level. Where heavy components or polymerizable materials would cause rapid deactivation of the carbon, the feed should be pretreated for removal of these constituents.

Fluid char . . . An adsorption method that appears to be well suited for the separation of certain lean-gas mixtures is a process developed by Esso Research & Engineering Co. and known as the fluid char adsorption (F.C.A.) process. Fig. 26 illustrates the basic features of such a system.[27]

In contrast with the moving granular adsorbent as used in the Hypersorption process, the fluidized char flows stagewise through the tower in the same way as a liquid in a conventional fractionator. The confined flow is necessary, as beds of random depth would give large backmixing which defeats the actual objective of efficient fractional separation.

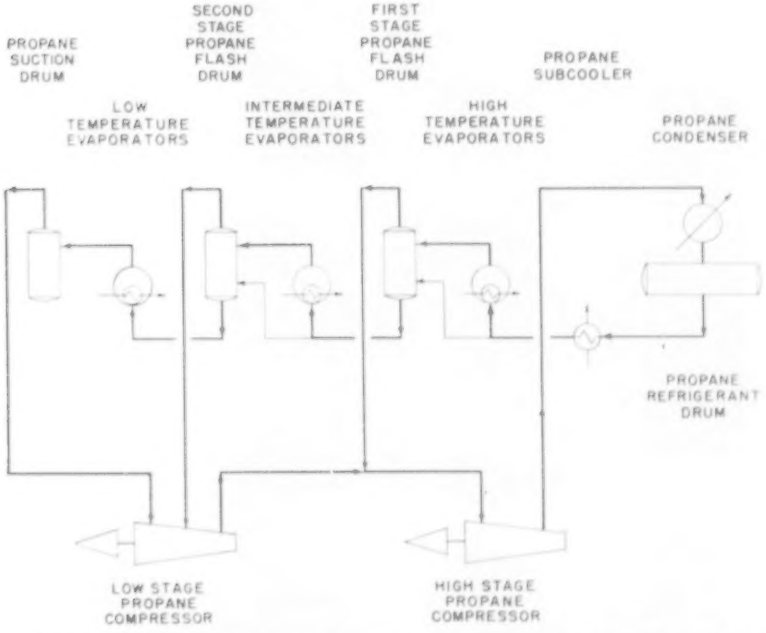
Trays are used as in a conventional bubble-cap fractionator and the char flows from tray to tray with the aid of downcomers countercurrent to the feed gas. Cooling and heating coils are used on the trays and because of the fluid behavior of the char in flowing across the trays, high heat-transfer coefficients are obtained. The F.C.A. process has two important advantages in that the char inventory is not large and the fluidized technique permits the reactivation of deactivated char by direct heating with combustion gas at high temperatures.

The flow of gas and sequence of process operations through the adsorber-desorber is similar to that in the hypersorber. Adsorption of ethylene and heavier constituents takes place in the section just above the feed injection. Stripping of the methane from the C_2 cut by refluxing with C_2's takes place at a point just below the feed introduction. The C_2 fraction is withdrawn at the top of the stripping section.

Below the C_2 concentration zone, C_3+ is stripped from the char and withdrawn. In the bottom of the desorption section the char is heated, stripped with steam, dehydrated with recycled residue gas, and cooled prior to being returned by gas lift to the top of the adsorber. The char may be dehydrated at the bottom of the desorber with recycle gas if a dry residue gas is desired. Otherwise it may be dehydrated at the top of the adsorber with the net yield of residue gas.

Maintain activity . . . Char activity must be maintained as in Hypersorption; otherwise a serious loss of capacity will result. Constituents which will polymerize readily and not become easily desorbed should be removed prior to entering the adsorber.

Extensive tests in a plant of semicommercial size with refinery gas have indicated that sharp separation between C_1 and C_2 and C_2 and C_3 are obtainable. In the pilot-plant operations, there were not many deactivants in the refinery gas and consequently after a considerable number of runs, the char activity dropped only to 80 per cent of initial activity and remained at this level for a long period of operation.



PROPANE REFRIGERATION SYSTEM which may be used with ethylene recovery units. Fig. 27.

Refrigeration Systems

The temperature level at which heat has to be extracted in an ethylene-recovery process will vary with the process used and especially with the extent of component separation attempted. Refrigeration, which is used in most ethylene-recovery installations, is in essence a means of elevating the heat level above that of normal cooling water. However, no matter how intricate

the refrigeration system, the ultimate rejection of heat is always to cooling water or in some cases a portion may be rejected to air coolers.

One of the simplest forms of refrigeration is commercially known as "steam jet refrigeration." Through the use of a steam jet refrigeration system, it is possible to cool water by evaporation and attain temperatures as low as 35° F. Refrigerated water should be considered when process temperatures of approximately 50° F. are required and a large surplus of low-pressure steam is available.

This type of system assures a controlled inlet water temperature and can be made to handle variable loads by using multiple jets with provision for cutting out as the load is decreased.

Ammonia refrigeration is used in some plants and may be of the adsorption or compression type. An ammonia-compression-type refrigeration system requires slightly less horsepower per ton of refrigeration for a given evaporator temperature than does a propane compression system. However, because propane is more readily available at refinery sites and is low in cost, it is preferred to ammonia.

Where utility costs are high, an ammonia-absorption-type refrigeration system might prove attractive, even though its first cost will be higher than an ammonia-compression system.

Limit suction pressure . . . It is good design practice to limit the low-stage suction pressure to a positive pressure. This establishes the minimum operating temperature for evaporators at approximately —25° F. for ammonia, —40° F. for propane, and —50°, F. for propylene refrigerants. The lower temperature level attainable at near atmospheric pressure evaporation is another reason for the use of the hydrocarbons rather than ammonia as the main refrigerant.

Halogenated hydrocarbons such as freons 11, 12, and 22, methyl chloride, and ethyl chloride, are rarely used in ethylene plants requiring large amounts of refrigeration as they are expensive and are not readily available. Therefore, the course of development has led to the use of ethylene, ethane, propylene, and propane as the most common refrigerants used in ethylene-recovery plants.

It is beyond the scope of this article to describe the numerous refrigeration systems which are provided in modern ethylene plants, and it should suffice to discuss the cascade system employed in the straight low-temperature-fractionation unit which generally requires the lowest coolant temperature level.

Fig. 27 illustrates the flow through a propane refrigeration system. Three levels of refrigeration are indicated. In a low-temperature-fractionation ethylene-recovery unit, propane refrigerant is used for feed cooling, for condensing reflux in the deethanizer and ethylene-ethane fractionators, and for condensation of the ethylene refrigerant.

Compressing propane . . . Propane vapors at approximately —40° F. and 15 psia. enter the low-stage propane compressor suction and are compressed to 245 psia., depending on the composition of the refrigerant and the available cooling-water temperature. The propane liquid after condensation is subcooled with process streams and then flows to the first-stage propane flash drum and the higher-temperature-level refrigerated coolers.

A portion of the vapor from the flash drum is used for reboiling, and the remainder combines with the low-stage propane compressor discharge and flows to the high-stage propane compressor suction.

Liquid from the first-stage propane flash drum flows to the intermediate temperature evaporators, and liquid from the second-stage propane flash drum flows to the low-temperature evaporators. The intermediate temperature vapors enter at an appropriate point in the low stage of propane compression, and the low-temperature vapors return to the suction of the same machine.

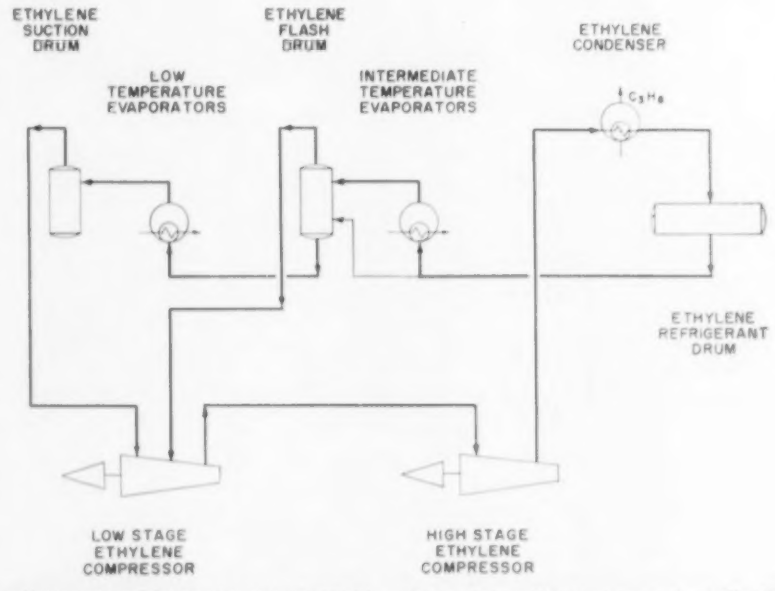
Fig. 28 shows the flow through an ethylene-refrigeration system. Ethylene is used at an intermediate temperature level for demethanizer feed precooling and at the lowest temperature level in the process, i.e., the condensation of demethanizer reflux. Refrigerant vapors from the lowest-temperature evaporator enter the suction of the ethylene compressor at approximately 15 psia., and the intermediate temperature vapors flow to the same compressor at an appropriate point and are compressed to 80 psia.

The discharge vapors enter the suction of the second stage, and are compressed to 270 psia. Condensation of the ethylene refrigerant is effected by propane. Conventional cooling cannot be used for condensation because ethylene would be above its critical temperature.

Application of several flashing stages increases the efficiency of a refrigeration cycle and results in lower compressor brake-horsepower. However, it is usually not economical to use more than two stages of flashing for propane and one stage of flashing for ethylene.

The additional cost of auxiliaries, such as compressor nozzles (in the case of centrifugal compressors) or compressor cylinders (in the case of reciprocating compressors), piping, valves, drums, and insulation, will outweigh the additional savings in operating cost obtainable with a more elaborate flashing arrangement.

Triple cascade refrigeration . . . This system, utilizing propylene, ethylene, and methane as refrigerants, has been used to produce temperatures of —200° F. and lower.[28] In such plants, the methane refrigerant is used for the condensation of demethanizer reflux and allows operating the demethanizer at pressures between 100 and 150 psia. The discharge of the methane com-



ETHYLENE REFRIGERATION SYSTEM is used at an intermediate temperature level. Fig. 28.

pressor at approximately 450 psia. is condensed by evaporating liquid ethylene.

Since the flow of methane refrigerant is not great enough even in relatively large plants to permit the use of centrifugal compressors, it is necessary to employ reciprocating machines. The methane, evaporated at —200° F., must then be heated to a temperature of —30° F. or higher prior to entering the compressor suction, corresponding to the minimum allowable operating temperature of piston compressors.

This is done by heat exchange with the compressor discharge. Facilities are required for providing the initial charge and makeup of refrigerant. Natural gas or demethanizer residue gas is usually the source of methane for this cooling service.

The refrigeration system of an ethylene unit is very important, since it represents a large part of the plant investment and continuous and efficient operation is essential to the best performance of the plant. The principal design aspects are economy in operation, flexibility with respect to changes in load resulting from variations in quantity and composition of the feed stocks, and automatic adjustment to the normal changes in coolant demand.

Plant-investment cost and operating expenses are closely related to the installed compressor horsepower. Some ethylene units have their refrigeration system integrated too closely with the process streams. Although this reduces the theoretical compressor horsepower, it will usually result in a sacrifice in plant flexibility.

In such cases, an upset in one part of the fractionation system is transmitted throughout the unit, and due to the interlocking of too many process sections, the restoration of normal operating conditions will require considerable time and will cause loss in production.

Most large ethylene units will utilize centrifugal rather than reciprocating machines for the compression of propane and ethylene refrigerant vapors in view of their lower installed cost and greater flexibility. On the other hand, the effect of steam, fuel, and power costs must be evaluated for each installation to determine the most desirable compressor driver from the standpoint of operating economy and proved performance.

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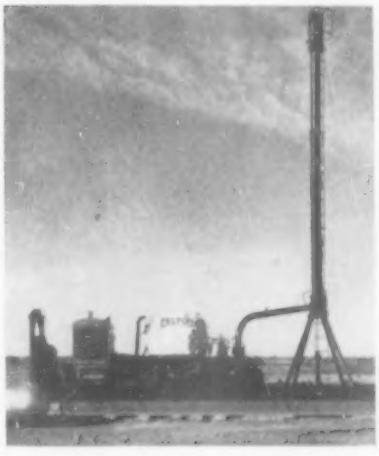
ON THE JOB . . . . . IN THE FIELDS



Pumping unit is skidded for portable use

LARGEST long-stroke hydraulic pumping unit adapted for portable use is being used by Shell Oil Co. in the Hobbs area of New Mexico. The 20-ft. stroke unit, with a rated polished-rod load of 30,000 lb., is skid-mounted and can be skidded and unloaded from a truck or trailer without use of a crane. During movement the hinged hydraulic cylinder is folded back on a support. Two bolts holds it upright after it is raised to the vertical position at the well site. The unit is shown in operation at an 8,000-ft. well.

•

Slip joint removes exhaust

TO reduce the chance for fires on pulling jobs, one major company has a short 2-in. joint of pipe which slips into a tee on the bottom of the truck exhaust manifold. When the rig is spotted on the location, the joint of pipe keeps the exhaust sparks away from the well head.

The connection is made by welding a piece of 2½-in. pipe on the bottom of the manifold where the exhaust pipe takes off to the back of the truck. The weld is made so that the nipple looks out toward the front of the truck. The extra exhaust pipe slips into this nipple.

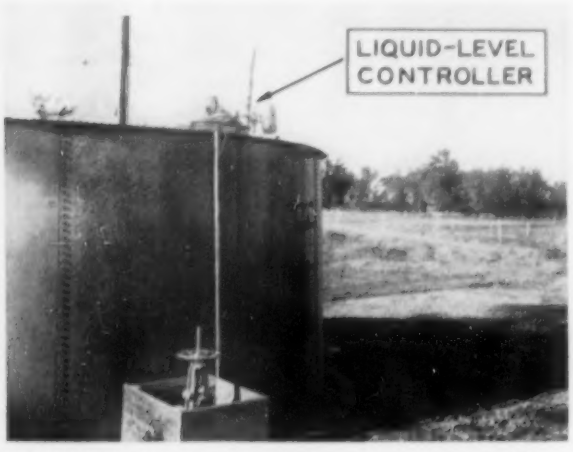
For road travel, the pipe joint is pulled out and laid on the truck bed and the nipple is plugged with a piece of 2-in. blank pipe. This forces the exhaust through the muffler. During the workover operation, it is not necessary to plug the regular exhaust pipe because the 2-in. pipe is so much larger and has so much less resistance that all of the exhaust gas will pass through it.

•

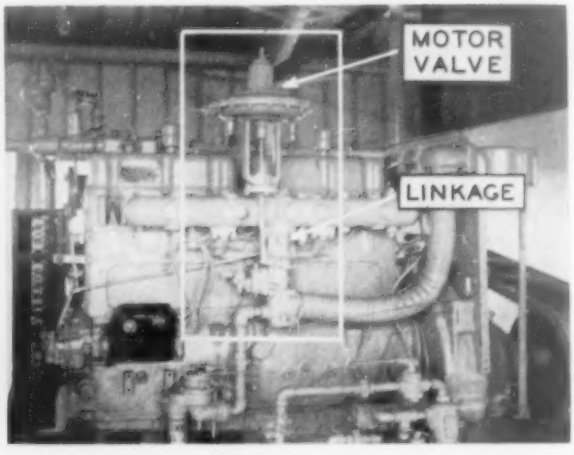
Thin emery wheel helps strip rods

WHERE the rods are paraffined up in the tubing and must be pulled at the same time as the tubing, one of the most disagreeable parts is the sawing of the rods when the coupling cannot be reached.

For this job, Steve Heffington, Jr., (owner, operator, pumper, and roustabout on his lease in the Jim Smith field in Travis County, Texas) simply plugs in an electric sander with a thin emery wheel and makes quick work of cutting the rods. The device is plugged into an electrical outlet at the pumping motor and left plugged in until rods and tubing are pulled. Although the well makes no gas, a piece of burlap is wrapped around the casing head as a safety measure against fire.



SURGE TANK now contains control to govern engine throttle.



MOTOR VALVE acts in accordance with level of the surge tank.

Control system improved by Sunray Mid-Continent as . . .

Float regulates engine throttle

USE of a liquid-level controller and a motor valve has eliminated the need for hand-throttling a water-injection pump engine on a Sunray Mid-Continent operation in North Louisiana.

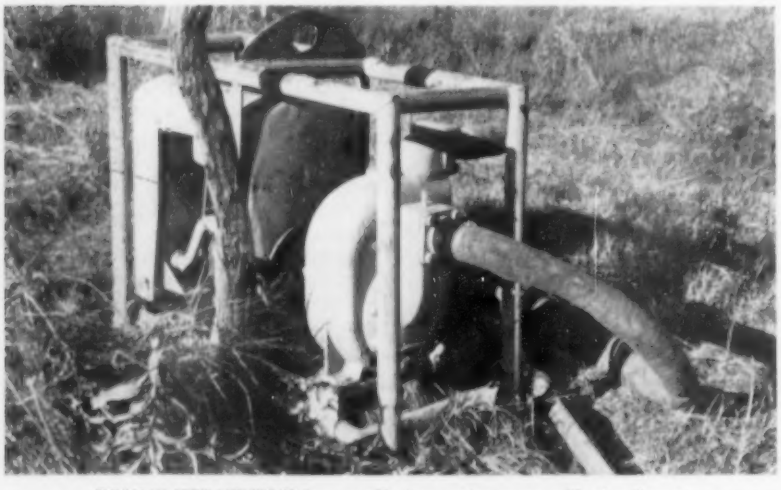
In the injection work, water is pumped from a well, then through sand filters before entering the surge tank from which the injection well pump takes suction.

Under previous conditions, it was necessary to hand-set the throttle on the pump engine when the pump was taking water from the surge tank.

Since the flow into and out of the surge tank varied widely, one throttle setting was not sufficient to maintain a suitable water level. The tank had to be checked intermittently and the hand throttle had to be adjusted accordingly. This need for supervision resulted in a waste of manpower.

Consequently, a control system was worked out using a liquid-level controller in the surge tank. The controller governs the actions of a motor valve mounted on the pump engine and connected by linkages to the hand throttle. The controller maintains a satisfactory water level in the tank by causing the motor valve to speed up or slow down the engine in accordance with the amount of water flowing into the tank. The governor of the engine is set to permit full operating power where it is needed.

With this simple control, the injection pump system operates without any supervision whatsoever, with the exception of a periodic check.



ROUGH TREATMENT has no effect on water pump with pipe frame.

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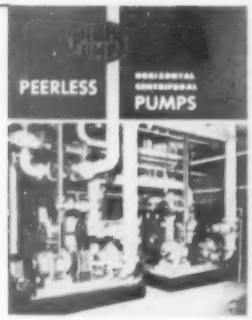
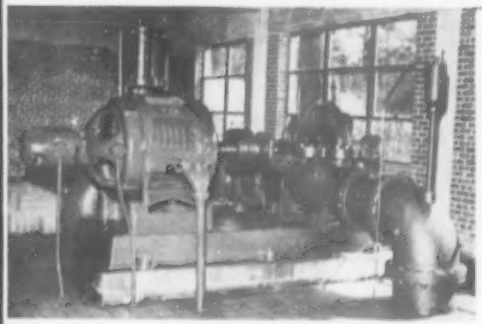
either way YOU LOOK AT THE PUMPING PROBLEM

VERTICAL

Ho Rizontal





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DISTILLATION—8

JOB IMPROVEMENT FOR THE PROCESS FOREMAN—63

Reflux Flow Rate Affects Distillation Product

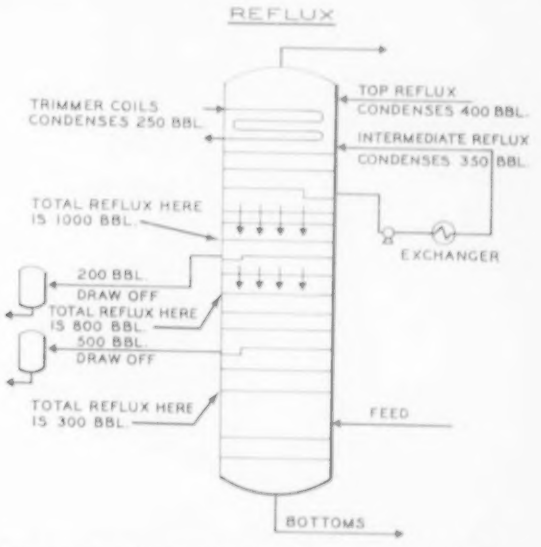
THE use of steam in distillation makes it possible to get a higher flash of overhead product with a lower transfer-line temperature. This reduces the stress of high temperature on the furnace tubes.

Tower temperatures . . . The top and bottom temperature of the side-draw tower are two critical points in maintaining efficient tower control. The temperature at the top of the tower controls the quantity of material passing out of the tower as overhead product. An increase in temperature means an increase in the amount of vapors going out and a heavier product. A decrease in top temperature results in less vapors removed and a product of lower end point. The temperatures maintained throughout the tower during any operation will depend on the properties desired in the products.

The temperature in the flash section of the tower is a major control of the quality of the bottom product. It is to be recognized, however, that reflux rates and quantity of stripping steam play equally important roles in the fractionation of various fractions. The heat of vaporization is, in most cases, added to the oil before it enters the tower, either by heat exchange with another material or in the furnace tubes.

In any case, the feed rate and the temperature should be constant because any variation in the bottom temperature is followed by a similar variation in the top of the tower and affects the quality of the products. Normally, the bottom temperature is run at the lowest temperature possible to obtain the desired product tests. This is good practice because any excess bottom temperature requires a higher reflux rate and unnecessarily loads the overhead condensers.

Quantity of stripper draw (reflux) . . . Variation in the amount of reflux flowing over the trays of a side-draw tower affects the product. In a series of separate towers this would not be true since each tower operates independently. The flow of reflux from tray to tray is constant at all times unless changes are made in the amount withdrawn to the strippers, or the top reflux is varied.



EFFECT OF PRODUCT WITHDRAWAL on reflux distribution in a side-draw tower. Fig. 6.

The tower illustrated in Fig. 6 is refluxed in three ways: (1) top reflux, which is a part of the condensed overhead product; (2) the trimmer coils, which circulates a cool material to extract heat from the tower top; and (3) the intermediate reflux system that takes hot liquid from the intermediate (or middle section) of the tower, removes the heat, and returns the cool reflux several trays above the draw-off point.

By noting the amount of condensed material moving down the tower in Fig. 6, you can see that any variation in the quantity of reflux drawn to a stripper changes the reflux throughout the remainder of the tower.

The stripper draws can be varied to control the properties of the stripper cuts. Opening a stripper draw makes that stripper product and the products below this point heavier. The products become heavier because the reflux, which is the excess liquid not drawn, flowing to the zones below is reduced. This allows more vapors to move up the tower and be removed as a liquid on the opened stripper draw. Since the material allowed to come up the tower is from the heavier product below, the opened stripper product is heavier and, consequently, the product to each of the lower strippers becomes heavier. Closing off a stripper draw has the reverse effect.

Flash, end point, viscosity, and other critical properties can be controlled by varying the stripper draws. The flash point, however, is the least affected and is usually controlled by varying the stripping steam within the stripper. For example, a stripper cut is running a low flash point, but all other properties are on test.

This material is taken from "Fundamentals of Refining," operating manual of Magnolia Petroleum Co., refining division, Beaumont, Tex.

ROCK-BIT DESIGN, SELECTION, AND EVALUATION—4

by H. G. Bentson

MODERN DRILLING

Drilling Experiences Affect Basic Bit Design

WITH the exception of journal angle and offset values, the foregoing has dealt primarily with those factors in rock-bit design imposed by geometric limitations. Unlike fundamental design, basic design criteria relate to those factors of a more arbitrary nature, or which are dictated by previous experience.

Design criteria such as tooth-to-tooth and tooth-to-groove clearances, bottom-hole coverage, cone-shell thickness, and bearing configuration, fall within this classification.

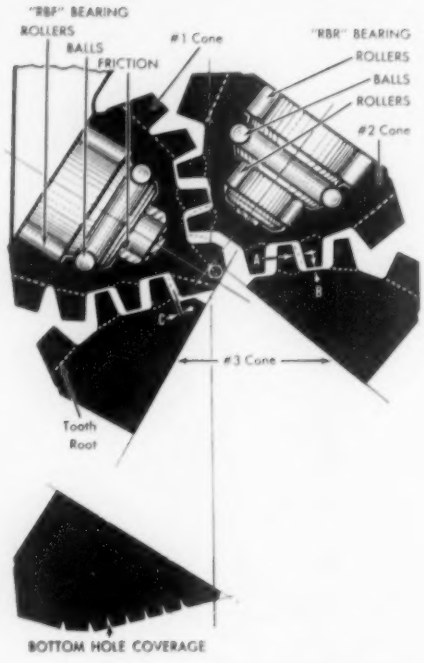
Clearances . . . A typical medium-formation three-cone design layout to which these design criteria have been applied is shown in Fig. 10. Since the design incorporates an offset, the cone sections lie in parallel planes, one above the other, by an amount which is a calculated function of the predetermined offset value.

Consequently, the apparent tooth-to-tooth A and tooth-to-groove B clearances may not always represent the actual clearances desired. Other methods must be employed, therefore, in the application of these design criteria as exemplified by the dash line between certain of the rows of teeth. The space C developed thereby, represents the true tooth-to-tooth clearances.

Obviously, tooth-to-tooth clearances must be closely controlled. Excessive clearance will result in inadequate bottom-hole coverage and subsequent accelerated wear of the ends of the teeth. Insufficient clearance, on the other hand, may cause eventual interference between mating cones.

Of equal importance is the design criteria for tooth-to-groove clearances. Within limits, these clearances are maintained as small as possible to utilize the maximum amount of space. Excessive values would of necessity result in a sacrifice of tooth depth, cone-shell thickness, and/or bearing size.

Hole coverage . . . The composite view of the cones shown below the cone cluster is required to determine the bottom-hole coverage. This layout presents an over-all check on the general tooth spacing and is required for the proper development of tooth balance, arrangement, etc. Note that spaces representing uncut bottom are kept to a minimum, and within limits, are balanced. Providing these spaces are kept uniform and within the limits shown, the teeth on an offset bit will wipe away any uncut bottom.



THREE-CONE bit design layout illustrating tooth-to-tooth and tooth-to-groove clearances, bottom-hole coverage, cone-shell thickness, and bearing configuration. Fig. 10.

Of prime importance from a strength standpoint is the cone-shell thickness. The cone shell is represented in Fig. 10 by the solid black section contained between the tooth roots and grooves and the inside of the cone. Insufficient area in this section can result in broken cones and loss of parts in the hole. Although varying thicknesses are used for different bit types, the designer must adhere to certain minimum values, which have been established.

Bearing types . . . In general, two different bearing arrangements are, or have been, used in the medium-size bits by various manufacturers. Additional bearing arrangements are also used in the smallest and largest sizes. The roller-ball-friction bearing arrangement shown in Fig. 10 may be referred to as an RBF type. The roller-ball-roller arrangement is referred to as RBR. As the designations imply, the basic dissimilarity between the two arrangements is primarily a difference in the inner or nose bearings.

The friction bearing used for the RBF type consists of a special case-hardened bushing pressed into the nose of the cone. The male or pilot is hard-faced with a special material which in combination with the bushing displays a low coefficient of friction and resists seizure and wear.

In operation, radial loads are supported by the outer and nose bearings. Although some radial loading may occur with bearing wear, thrust or longitudinal loads in either direction are sustained by the balls. It is obvious that under these conditions, the balls also serve to secure the cones on the legs.

Author is chief sales engineer with H. C. Smith Tool Co., Compton, Calif.

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PORTABLE-GASOLINE-PLANT SYMPOSIUM

Cost Factors May Control Midget-Plant Design

by W. W. Pyeatt

CLAYTONVILLE GASOLINE PLANT—3

THE factors governing the success of midget gasoline plants, though much the same as in larger plants, must be given even closer scrutiny in many instances to allow one to walk the economic tightrope. These factors in the order of importance are:

1. A thorough evaluation of gas reserves available to the plant and just as thorough study of the rate at which the reserves will be made available.

2. Composition of gas and expected recovery must include evaluation of these factors over the life of the reserve; as well as seasonal effects which can also be important.

3. Marketing evaluation is as complex and as demanding as other factors and precludes the thought that recovery of product is enough. This requires study of general market trends, local trucking market, rail facilities, crude-oil or product pipeline market, geologic possibility of underground storage, and certainly road conditions to the plant site. Gasoline plant possibilities are nearly always found in areas of existing plants where the new venture will sharpen the competitive battle yet could lend to cooperative efforts toward underground storage where feasible. In the southern states, the sale of propane in the summer necessitates tank car or product-line movement north, while in the north, butane selling is equally troublesome in the winter.

4. The study of plant cost involves the study of each part with all the logical alternatives examined in order. The plant cost must consider the various marketing possibilities. An example of the consideration to be given a plant design may be gleaned from the following table based on the Claytonville plant.

Author is with Claytonville Gasoline Co., Sweetwater, Tex. Paper presented at the N.G.A.A. thirty-fifth annual convention, Fort Worth, April 11-13, 1956.

Claytonville Plant-Design Economics

Items of cost are tabulated percentagewise against the choice of a plant to recover: (1) gasoline and salable residue gas only; (2) gasoline, residue and butane; and (3) gasoline, residue gas, butane, and propane. The per cent of potential gross revenue is shown also. Plant 3 represents 100 per cent cost and revenue.

This illustrates in a stream rich in butane and propane, the need to recover and market these products. At Claytonville plant a very low-temperature refrigeration-type plant to recover maximum propane was indicated.

5. Operating costs naturally follow the determinations of design, recovery, and marketing.

Thorough evaluation of these factors should finalize the design including the degree of automation and portability desired and allow reasonable prediction of the financial success of a midget gasoline plant.

Items of cost—	(1)	(2)	Per cent (3)
Gathering system	15.8	15.8	15.8
Compressor station	40.7	42.4	42.4
Process equipment	20.6	29.2	29.8
Marketing and storage	3.1	4.2	10.5
Land and improvements	1.4	1.4	1.4
Total	81.60	93.00	100.00
Per cent of cost saved	18.4	7	0
Per cent revenue	51.9	74.9	100.00

COMING NEXT . . .

Experience with the Lake Chicot automatic gasoline plant is told in the next series by E. S. Wenger of Amerada Petroleum Corp. An absorption-type plant is used on the rich quality casinghead gas of the major reservoir of Lake Chicot field in Louisiana. Investment and operating costs are given plus instrumentation and operating history for the portable plant handling some 2,000,000 cu. ft. daily.

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The Houdresid Process eliminates the production of heavy residual fuel by making it practical and economical to catalytically crack the bottom of the petroleum barrel. This refinery-proved, continuous moving bed process converts reduced crudes into exceptional yields of high-octane gasoline and light distillate fuel. The process is well adapted to the use of synthetic or natural clay catalyst, and to the charging of a wide range of reduced crudes.

The problem of heavy metal contamination usually associated with catalytic cracking of residua has been successfully eliminated by the Houdresid process. This has been conclusively demonstrated in both pilot plant and commercial refinery operations. One commercial Houdresid unit has been in operation for over 2 years.
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PAINTING STEEL—5

Two Ways to Check Paint-Film Thickness

by J. O. Jackson* and Joseph Bigos†

PAINT should be applied at the viscosity recommended by the formulator or manufacturer of the paint. Generally, it is at the proper viscosity for brush application when procured.

Spraying may require further dilution with thinner, but large amounts are seldom required. Most paints that are of satisfactory viscosity for brushing may be applied by spray. In cold weather, when the viscosity of paint increases, the brushing becomes hard work; and the painters add thinner which results in a paint film of too-low thickness. In cold weather paints should be warmed rather than thinned.

Inasmuch as the paint-film thickness is the most critical factor of application, it should be checked carefully. Two methods are now available for checking paint-film thickness: (1) To compute the dry-film thickness based upon the coverage obtained in square feet per gallon, after making due allowance for paint losses; and (2) to utilize paint-film-thickness meters. Two types are available: the wet-film-thickness gage which permits paint to be checked for thickness immediately upon application, and the dry-film-thickness gage.

Priming coats of paint for steel structures should have a minimum of 1½ mils of paint per coat; 2 mils are more desirable and often possible. Intermediate and finish coats should have a minimum of 1 mil with 1½ mils being preferable. Unconventional paints, such as the lacquer type or the thick bituminous coatings, obviously do not fall within these ranges.

Although 5 mils are considered to be much more desirable, sufficient coats of paint should be applied so that at least 4 mils of dried paint are obtained.

Detailed guide . . . The other factors of application which affect paint performance are well known and will not be dealt with in detail. The first detailed guide for adequate inspection of cleaning and painting, Good Painting Practice,[1] has recently been published. The surface should be clean and dry when painted.

If some time has elapsed since cleaning, the surface should be checked for further deposits of dirt or other contaminants that may have occurred. If the surface is blast cleaned or pickled, painting should take place prior to the formation of any rust on the surface.

Care should be exercised that contaminants and corrosion stimulators, such as salts, dew, etc., will not contaminate the surface prior to painting or between coats of paint.

Painting should be done during dry weather with the relative humidity lower than 85 per cent; the air temperature above 40° F.; and the surface to be painted dry and at least above the freezing point of water. If there is danger of rain, snow, or freezing temperatures before the paint is dry, painting should be delayed.

Preceding coats of paint should be dry before further coating; however, there exists a danger of paint becoming too dry for satisfactory repainting. Fresh linseed-oil paints may, upon drying too long, be difficult to wet with subsequent coats of paint and crawling (the gathering of paint with exposure of unwetted substrate) may ensue. Phenolic paints are notorious for drying too hard for satisfactory recoating, resulting in poor adhesion of subsequent coats.

When paints are too dry and hard for satisfactory recoating, the surface should be lightly abraded with fine steel wool, sandpaper, or rubbed with solvent-wetted rags. The addition of powerful solvents, such as methyl isobutyl ketone or cellosolve, to subsequent coats of paint has been advantageous in promoting adhesion under these circumstances. Care must be exercised, however, that the added solvent does not act as a paint remover and lift the preceding coats of paint.

Long paint life . . . Proper drying conditions are advantageous in obtaining long paint life. Obviously it is difficult to control the drying conditions in the field as easily as the conditions in the shop. When possible, paint should not be exposed until it is dried thoroughly. If painted steel is to be immersed in water, the longer the paint is dried before immersion the better the resulting service.

Finally, the paint itself will be considered. The first requirement for a paint system is that the material be adequate to perform the services expected in the environment and on the type of structures to be protected. A suitable selection must be made of primer, intermediate, and top coats. The primer must have the correct pigments for inhibiting corrosion; and the vehicle must have sufficient wetting ability to develop proper adhesion to the type of surface to be painted—this latter factor is critical in deciding paint performance.

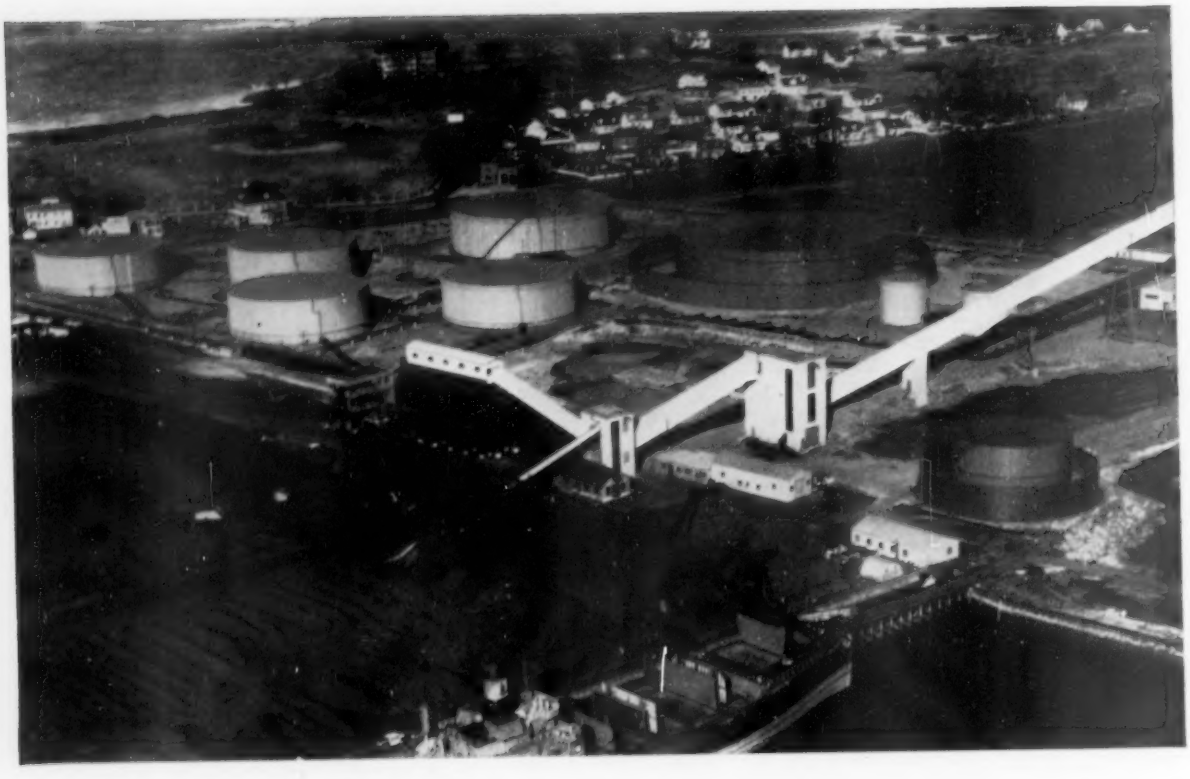
If the primer is used as a shop coat, it must be capable of protecting the steel from the time of shipment to the time it is erected and field coated. When field coating or finish coating is applied at a relatively short period after application of the primer, the primer need not have as great weather resistance. The second coat of paint should be one which has some degree of rust-inhibiting properties, but it should also have inertness and increased resistance to the passage of water and oxygen. Inasmuch as it must wet only the primer, the wetting characteristics need not be as strong as those of the primer; faster-drying synthetic paints are generally satisfactory.

The paint then has improved durability in severe exposures. The outer coat of paint must be pigmented so that the color retention is good when color is important.

*Pittsburgh-Des Moines Steel Co., Pittsburg. †Senior Fellow, Mellon Institute of Industrial Research. Paper presented at A.P.I. Refinery Division meeting, Montreal, 1956.

Reference

1. Bigos, Joseph, "Good Painting Practice" Vol. 1, "Systems and Specifications" Vol. 2, Steel Structures Painting Manual published by Steel Structures Painting Council, Pittsburgh, Pa. (1954-1955).



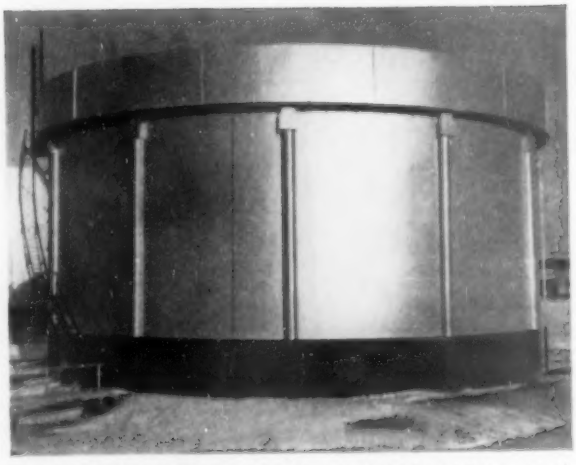
Big Tanks at Salem Harbor

Here is one of New England's largest, most up-to-date oil storage installations—Salem Harbor Terminal in Salem, Mass. Operated by Pocahontas Fuel Company, the terminal has a capacity of over 700,000 bbl of No. 2 and Bunker "C" fuel oils, plus large stocks of coal for such industrial users as New England Electric System's large, modern steam electric plant just beyond the picture at right.

Modern coastwise tankers berth at the deep-water dock and discharge their cargoes at a rate of 8,000 bph. Tank trucks are loaded fast at high-speed racks. This terminal can service 500 to 600 trucks per day on a 'round-the-clock schedule.

The seven large storage tanks you see here, all fabricated and erected by Bethlehem, total 700,000 bbl of storage capacity. One of them measures 200 ft in diameter by 40 ft high and has a capacity of over 220,000 bbl of oil. The others vary from 35,000 bbl to 143,000 bbl.

Many leading terminals throughout the East include tanks of Bethlehem design and construction. Floating-roof tanks (pontoon, double-deck and pan-type roofs) as well as lifter-roof and cone-roof types. We build them all. We'd be happy to give you further information. Just call or write the Bethlehem sales office nearest you.



PREVENTS BREATHING LOSSES. The Bethlehem lifter-roof tank is engineered like a single-lift gas holder. The roof rises smoothly in the heat of day; lowers at night. There's practically no loss of product. Designed to withstand weather extremes. The 54,000-bbl tank shown here is in service at Pocahontas' South Portland, Me., terminal.

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On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

18. Instrumentation Costs

by W. L. Nelson
Technical Editor

ALTHOUGH the total cost of installed instruments may be estimated from Table 2 as percentage of the total plant cost, more dependable costs may be obtained from Table 1. In addition to the cost of the instruments and the cost of setting them, the instrument-board labor and auxiliaries amount to 20-30 per cent more. Unfortunately, it is also usually necessary to spend significant sums to put the instruments in good operating condition when the operating staff is assigned the task of installing them.

Cost Indexes of Instruments (1946 = 100)[1]

	Composite	Flow	Temperature	Pressure % control valves	Pressure gages	Wages electrical	Nelson[2] Construction
1946	100.0	100	100	100	100	100	100.0
47	113.0	102	111	113	109		117.0
48	120.0	103	114	116		124	132.5
49	123.1	124	129	130	100	135	139.7
50	127.8	129	134	134	101	138	146.2
1951	142.3	145	142	154	109	149	157.2
52	146.2	149	148	157	109	157	163.6
53	151.9	157	155	163	109	164	173.5
54	154.6	163	159	164	109	168	179.8
55	162.9	173	171	168	112	173	184.5

TABLE 2
Approximate Costs of Installed Instruments[1,3,4] as Percentages of the Total Plant Cost*

Process industries	5-10
Petroleum refineries	†4.7 (3.4-5.7)
Gasoline plants	†3.0 (2.0-3.6)
Cracking plants	†4.6 (3.4-6.0)
Ethylene plants	†3.9 (3.0-4.6)
Alkylation (HF)	5.7
Gas recovery	4.9
Distillation	5.3 (5.1-5.6)
Solvent dewaxing	3.0
Styrene	4.0
Butadiene	5.5-5.8
Ammonia	3.0
Ammonium sulfate	2.2
Nitric acid and ammonium nitrate	2.0
Fischer-Tropsch	10.0

*The process plant cost-control of Costimating No. 4, The Oil and Gas Journal, January 2, 1956, p. 120. †Percentage of Basic Process Equipment (M and L), refineries 11.9; gasoline plants 6.5; cracking plants 11.7; and ethylene plants 9.5.

References

1. Nelson, W. L., Instrumentation, The Oil and Gas Journal, June 9, 1949, p. 101.
2. Nelson, W. L., The Nelson Index, The Oil and Gas Journal, July 27, 1952, p. 105. (In addition, it is published in the first issue each month as well as a comprehensive list of indexes in the quarterly issues of January, April, July, and October.)
3. Author's files.
4. Platt and Farrar, Third World Pet Congress, Sect. VI, p. 488 (1951).

Table 1—Approximate Costs (1946) of Control Instruments.* Dollars Each

	Material Dollars	Labor Dollars
Industrial thermometers, complete	13-27	5
Wells for thermometers or couples	3-8	
Thermocouple only, light	15-23	
Thermocouple only, heavy-duty	20-30	
Thermocouple compensating leads	‡26	‡6-7
Thermocouple complete, light	19-43	1-5
Thermocouple complete, heavy-duty	80-120	3-6
Conduit—½-in.	‡10-14	‡40
Conduit—¾-in.	‡13-17	‡40
Conduit—1-in.	‡20-24	‡40
Temperature alarm	130	
Temperature indicator	40-160	
Temperature indicator, 12-point complete	320-470	20-50
Temperature recorder	110-230	17-30
Temperature controller (no valve)	100-150	4-6
Temperature recorder—single point	260-350	25-40
Temperature recorder—2-point	420	25-40
Temperature recorder—3-point	450-490	25-40
Temperature recorder—4-point	500-590	25-40
Temperature recorder—6-point	600-690	25-40
Temperature recorder—10-point	665	25-40
Temperature recorder controller	180-370	25-50
Temperature recorder, elaborate	425-620	30-60
Furnace temperature flame control	40-50	
Pressure gages or indicators—light	7-21	1-2
Pressure gages or indicators—flush mounted	30-50	16
Pressure gages or indicators—heavy duty	15-50	2
Pressure recorder (single or double-pen)	80-140	20-30
Pressure regulator, gas or steam	45-97	20
Pressure controller	100-260	10-30
Pressure recorder controller	130-260	20-30
Pressure recorder controller (elaborate)	430-860	30-50
Draft gage	33-80	20-30
Instrument air regulator	11-20	
Pressure alarm, T.C.C.	130	
Gage columns or glasses	45-90	10-15
Level indicator complete	90-175	15-20
Level control, low-pressure	105-140	
Level control, regular	135-335	15-30
Level alarm	77	
Displacement meter	50-180	10-20
Meters, elaborate	210-380	15-30
Rotameter	50-200	5-10
Orifice plates with flanges	30-75	5-10
Flow indicator	50-165	
Flow recorder, simple	170-270	15-30
Flow recorder, elaborate	360-500	20-40
Flow recorder, controller	320-820	30-45
Flow alarm	130	
Mercury, per instrument	30-100	
Relief valves—regular	70-130	20-30
Relief valves—vacuum	120-150	
Relief valves—extreme pressure	180-290	30-40
Panel board, ½ in. thick	‡1.40-1.80	‡1
Panel board, 1 in. thick	‡2.10-3.60	‡1
Air compressor, for instruments	150-190	105
Air filters	6-11	
Oil strainers	40-60	10-20
Steam traps	12-21	
Steam traps, continuous	104	
Clock	55-63	
Instrument board labor and auxiliaries		†20-30

*Primarily from author's files but also see "Instrument Costs," The Oil and Gas Journal, January 16, 1949, page 141. †Percentage of the total cost of installed instruments. ‡Cents per foot. ‡‡Dollar per square foot.

THIS KIND of CRAWLER
HD-16
141 BELT HP,
36,903 LB AS
ILLUSTRATED
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98 BELT HP,
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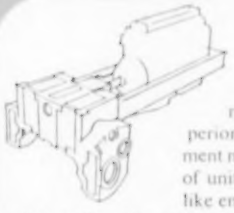

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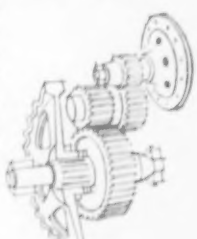
Allis-Chalmers Heavy-Duty Diesel Engine. The power plant is designed for big output, ample reserve capacity and low maintenance. Energy cell controls combustion timing and pressures for high efficiency. Tornado turbulence mixes air and fuel thoroughly for more complete burning. Follow-through combustion sustains effective working pressures to take advantage of better crankshaft leverage.

Extra Clutch Life—with Ceramic Lining. Master clutches offer simple, single-plate, over-center design. Revolutionary new ceramic button clutch lining keeps clutch operating longer between adjustments . . . lengthens clutch life . . . reduces lever pull for easier operation.

Straddle-Mounted Final Drive Gears. Tapered roller bearings support both ends of the final drive gear shafts. Smaller gears and shorter shafts (plus line-bored, one-piece case), provide better bearing and gear alignment, more strength, longer life. Double-reduction final drives provide greater ground clearance.



New Design, Heavy-Duty Track. Long life under the toughest conditions. Side bars have more steel where it's needed . . . benefit from new heat-treating methods which make possible new standards of strength and hardness throughout for extra wearability.

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At no extra cost, you get roller bearing truck wheels, idlers and support rollers; 1,000-hour lubrication intervals for truck wheels, idlers and support rollers; 24-volt direct electric starting; crankcase guard; bumper; and lights.

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To begin with, we don't heat-treat "by the book," but by actual test. (The reactions, the hardenability, of two different lots of the same specification steel vary more widely than most people would think possible.) So we put samples of each lot through the whole heat-treating cycle . . . then, when actual bit parts are heat-treated, we *know* what temperatures, what times, what quench, are required for ultimate strength. And, as you'll note from the charts on the right, every step and every property — hardness, case depth, points of carbon in carburizing — is checked, charted and absolutely controlled.

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Drilling Contractors

H. L. Rowley, Inc., Shreveport, has a new contract operation in Jefferson County, southwestern Mississippi. It is a lower Tuscaloosa test, scheduled to go to 9,500 ft. It is being drilled for Charles A. Perkins, John S. Miller, and Jones & Linam. Location at 1 Lehmann-Hirsch, in 39-10n-1w, is 2½ miles southeast of production in Rodney Island field.

Don Johnston Drilling Co., Denver, is drilling for Kingwood Oil Co. and Aurora Gasoline Co. at a rank wildcat location 8 miles northeast of Genoa, in Lincoln County, East Central Colorado. The test is carried as 1 Ewing. Spot is in 5-8s-54w.

Don M. Rounds Drilling Co., Denver, has a new wildcat operation scheduled in Logan County, northeastern Colorado. The contractor is associated with Halbert, Jennings & Simic, independents, in the project. Location is for 1 Sprague, in 32-10n-48w. It is 5 miles southeast of Crook.

Sunnyland Contracting Co., Rayne, La., has contracted for another test Serio-Punches Oil Co. and T. J. Glennon will drill in the Soapstone area, 10 miles northeast of Woodville, in Wilkinson County, southwestern Mississippi. It will be a west offset to the field's discovery well, completed in July 1951 as an oil producer in a 7,450-ft. Wilcox sand. Two tests drilled since the discovery well have been dry. The new test will go to 7,800 ft.

Green & Heiser Drilling Co., Bakersfield, Calif., is drilling for Reserve Oil & Gas Co. at a wildcat location 2 miles north of production of Tejon Hills Ranch field, 25 miles southeast of Bakersfield, in southern Kern County. It is a deep test, possibly to 9,000 ft. Sunray Mid-Continent Oil Co. and The Texas Co. are associated with Reserve in the project, located in 20-11-19.

Calvert Drilling Co., Oklahoma City, and Olney, Ill., has a new wildcat job in Logan County, northeastern Colorado. It is for Arrowhead Exploration Co. at 1 Gentry, in 17-11n-49w, 6 miles northwest of Crook in the northeastern corner of the county. It also has a new wildcat test under way for its own account and R. P. Johnson at 1 Newbold, in 3-15n-53w, about 15 miles northeast of Kimball, in northeastern Kimball County, southwestern Nebraska. It is 4 miles southeast of Schneider field.

Peterson Drilling Co., Shreveport, has contracted with Amerada Petroleum Co. for a deep test in northern Issaquena County, western Mississippi. Location is on Amerada's Delta Wild-

ON THE FLOOR of the new mobile offshore-drilling platform placed in service by Morris & Hamilton, Inc., Houston-headquartered contract-drilling firm. At the control-console of the platform's large Wilson rig are, left to right: Dewey Morris, of the contracting firm; and John and Jack Wilson, of Wilson Manufacturing Co., Wichita Falls. A total of 2,490 hp. is available for operation of the drawworks and pumps.

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Cut shop expense on your drill collars by using 'Bestolife Lead Seal. Because of its high percentage of powdered metallic lead, 'Bestolife is heavy enough to stay on threads and shoulders instead of being squeezed out. This gives you extra tight leak-free joints, which are easy to break out. That's why 'Bestolife is first choice with tool pushers all over the world. See your local supply store for 'Bestolife. In 1¼, 5, 20 and 50 lb. cans. Unconditionally guaranteed.

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Edward Valves, Inc., Subsidiary of Rockwell Manufacturing Company, East Chicago, Ind.

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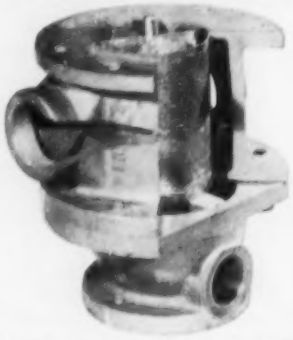

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A cylindrical screen within a body with a multi-bladed rotor that rotates by force of fluid flow. Wiper blades on the outer edge of rotor paddles continually wipe the cylindrical screen clean and the debris drops into a catch basin.

When catch basin is full of debris a quick opening valve on the drain line is opened momentarily to clean the basin.

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199

life & Forestry, Inc., lease about 2 miles northeast of Valley Park. Spot is in 5-9n-6w. It is a rank wildcat. Associated with Amerada in the venture are Donald M. Reese and Vaughey & Vaughey, who assembled the lease block. Plans call for an 8,000-ft. test.

Circle Drilling Co., Lake Charles, La., has scheduled a 12,500-ft. test to be drilled for Texas Gas Exploration Co. of Houston, at a wildcat location about midway between Rosedale and Bayou Des Glaise fields, in Iberville Parish, Coastal Louisiana. The operation is at 1 Wilbert, in 72-8s-9e.

Blanton Drilling Co., Houston, will drill a 7,100-ft. wildcat test about 1½ miles southwest of Nada field, in Colorado County, South Texas. It is a joint operation with H. A. Bornefeld, Jr., at 1 Riha, in Section 22, GC&SF Survey. Location is 5 miles west of Nada townsite, and about ½ mile from the Wharton County line.

Loffland Brothers Co., Tulsa, will be the contractor on Superior Oil Co.'s new deep wildcat test about 5 miles northwest of the Little Chenier area, in the coastal marshes of South Central Cameron Parish, southwestern Louisiana. Location is for 1-L Miami Corp., in 31-13s-6w. A 13,000-ft. test is scheduled.

A. W. Williams Drilling Co., Mobile, Ala., is drilling for C. E. Love and associates at a wildcat location 4 miles east of Valley Park, in northern Issaquena County, western Mississippi. It is a 4,500-ft Glen Rose test, listed as 1 Kirkland-King with location in 8-9n-7w.

Miller Drilling Co., Jackson, Miss., has a new wildcat operation 8 miles southeast of Waynesboro, in eastern Wayne County, southeastern Mississippi. It is a contract job for W. L. Pickens, of Dallas, at 1 McIlwain, in 30-8n-5w. Hole is to be carried to 6,000 ft.

Woolf & Magee, Tyler, Tex., will drill for Serio-Punches Oil Co., of Natchez, at a wildcat location 2 miles southeast of Woodville, in southern Wilkinson County, southwestern Mississippi. Contract calls for 8,700-ft. drilling. Location is for 1 White estate, in 2-1n-2w.

H. L. Rowley, Inc., Shreveport, is scheduling a new operation in the Vernon area, Adams County, southwestern Mississippi. It will be a 5,850-ft. Wilcox well for Rimrock-Tidelands, Inc., and T. J. Glennon at 1 Winston-Lambdin Unit, in 54-8n-2w.

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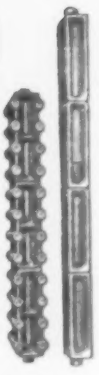

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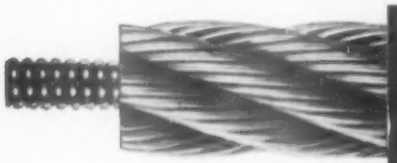

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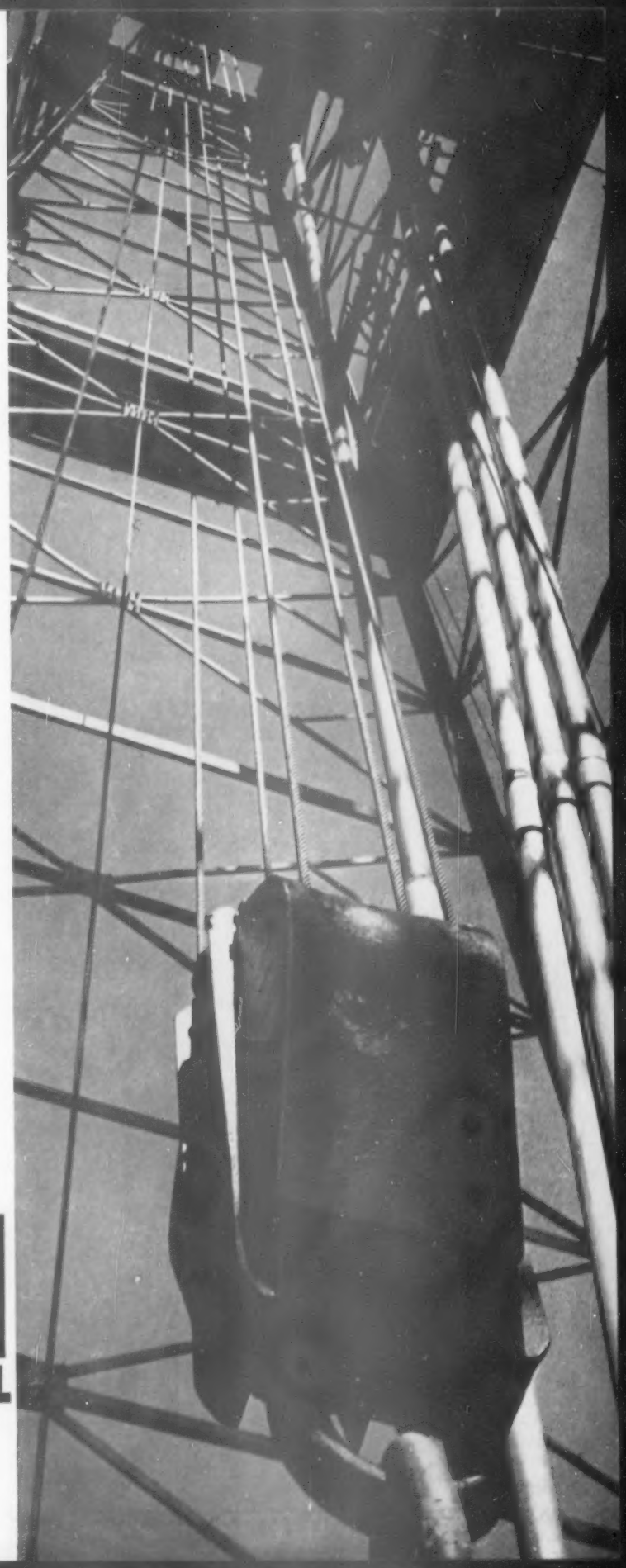

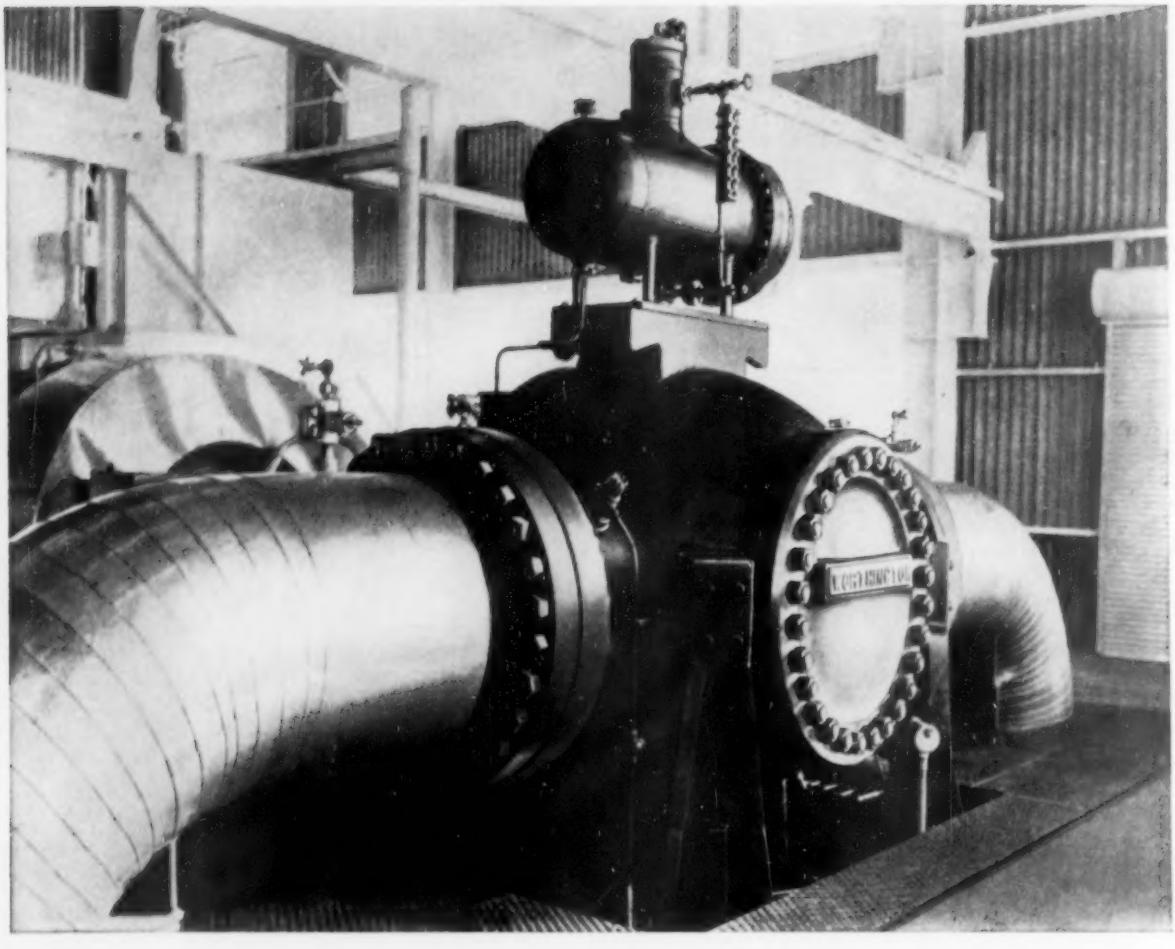

First "Center Line" Centrifugal Booster completes 18 months of pipeline service

Records show "practically no maintenance required"

This "new design" gas pipeline compressor has more than lived up to its advance billing. In service at Northern Natural Gas Company's Macksville, Kansas, station, since December, 1954, it has averaged 800 million cubic feet per day at a pressure of 500 psi. Records show that it has required practically no maintenance.

A brand new idea in compressor design, Worthington's type GUP compressor has a spherical casing supported at the center line. As a result, shaft distortions are minimized, starting stresses reduced, and bearing life extended.

A separate compressor driven pump supplies oil pressure at all times. By adding a cooler, the system may be made completely independent of the driver. A double trap in the scavenging system insures that no seal oil will seep into the gas stream.

It's easy to inspect. No internal part is too heavy for one man. The lightweight impeller, for example, weighs only 100 lbs.

If you'd like more information about this new pipeline compressor, write for bulletin C-1100-B57 to Section E66, Worthington Corporation, Harrison, N.J. In Canada: Worthington (Canada) 1955, Ltd., Toronto, Ontario. E-6-6

WORTHINGTON

A new chart for use in gas-flow calculations

by M. Navidi

VARIOUS empirical equations have been developed for gas-flow measurements and pressure-drop calculations in pipes. However, the most practical one is the following:

$$Q = 198.8\,[D^5(P_1^2 - P_2^2)/SFTZL]^{1/2}$$

Where:

- Q = flow rate M.c.f.d. at 14.7 psia. and 60° F.
- D = actual pipe i.d., in.
- P_1 = initial pressure, psia.
- P_2 = final pressure, psia.
- S = specific gravity of gas (air = 1.00)
- T = temperature at flowing condition, °R.
- F = friction factor, dimensionless
- Z = compressibility factor, dimensionless
- L = pipe length, ft.

A graph has been prepared based on the above equation (Fig. 1). Q is in million cubic feet per day along the vertical axis and $(P_1^2 - P_2^2)$ per 1,000 ft. of pipe along the horizontal axis. This graph avoids laborious calculations and gives fairly accurate results.

All the variable factors are included in the graph except compressibility factor Z which varies along the length of the line since it is a function of pressure. However, by using an average value of Z in the following manner, accurate value for Q and $(P_1^2 - P_2^2)$ may be obtained:

$$Q\ (\text{actual}) = Q\ (\text{chart})\ (Z)^{1/2}$$

$$(P_1^2 - P_2^2)\ (\text{actual}) = (P_1^2 - P_2^2)\ (\text{chart})\ (Z)$$

Compressibility factors may be read from graphs prepared by Paul Buthod in the *September 8, 1949 issue of The Oil and Gas Journal.*

Author is process superintendent for Iranian Oil Exploration & Production Co.

The following illustrations will be a good guidance for using and comparing the chart with actual and calculated data.

Illustration No. 1 . . . Assume 8.0 M.M.c.f.d. of natural gas (specific gravity = 0.65 and temperature = 70° F.) flows through a 6-in. i.d. pipe. If initial pressure is 450 psig., find out the final pressure at terminal 100,000 ft. away and calculate pressure drop.

Solution . . . Viscosity of gas at flowing condition is 0.0107 cp. from *Viscosity Chart for Hydrocarbons, The Oil and Gas Journal, December 1, 1945, page 76.*

$$R_e = 20.15 \times \frac{8{,}000 \times 0.65}{6 \times 0.0107} = 1.628 \times 10^6$$

Therefore:

$$F = 0.0155;\ Z = 0.93$$

$$Q = 198.8\,[D^5(P_1^2 - P_2^2)/SFTZL]^{1/2}$$

$$\frac{8{,}000}{198.8} = \left[\frac{7{,}776\ (P_1^2 - P_2^2)}{0.65 \times 0.0155 \times 540 \times 0.93 \times 100{,}000}\right]^{1/2}$$

(Compressibility factor of natural gas by Paul Buthod, September 8, 1949, The Oil and Gas Journal.)

$(P_1^2 - P_2^2) = 103{,}000$; $P_1 = 455$ psia., and $P_2 = 336$ psia. or 321 psig.

$$\Delta P = 450 - 321 = 129 \text{ psi.}$$

Solution by chart . . . On the vertical axis follow 8.0 M.M.c.f.d. horizontally to the 70° F. line, then extend it diagonally to the 60° F. line and then horizontally to 6-in. i.d. line now vertically downward to 0.60 specific gravity line, diagonally to 0.65 specific gravity line and read the value of 1,150 $(P_1^2 - P_2^2)/1{,}000$ ft. and now upon correction for Z, it becomes actual $(P_1^2 - P_2^2)/1{,}000$ ft. $= 1{,}150 \times 0.93 = 1{,}070$ or $107{,}000/100{,}000$ ft.

$P_2 = 330$ psia. or 315 psig.

$$\Delta P = 450 - 315 = 135 \text{ psi.}$$

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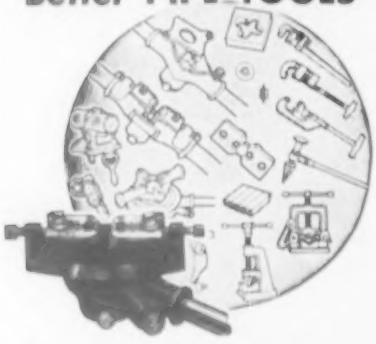

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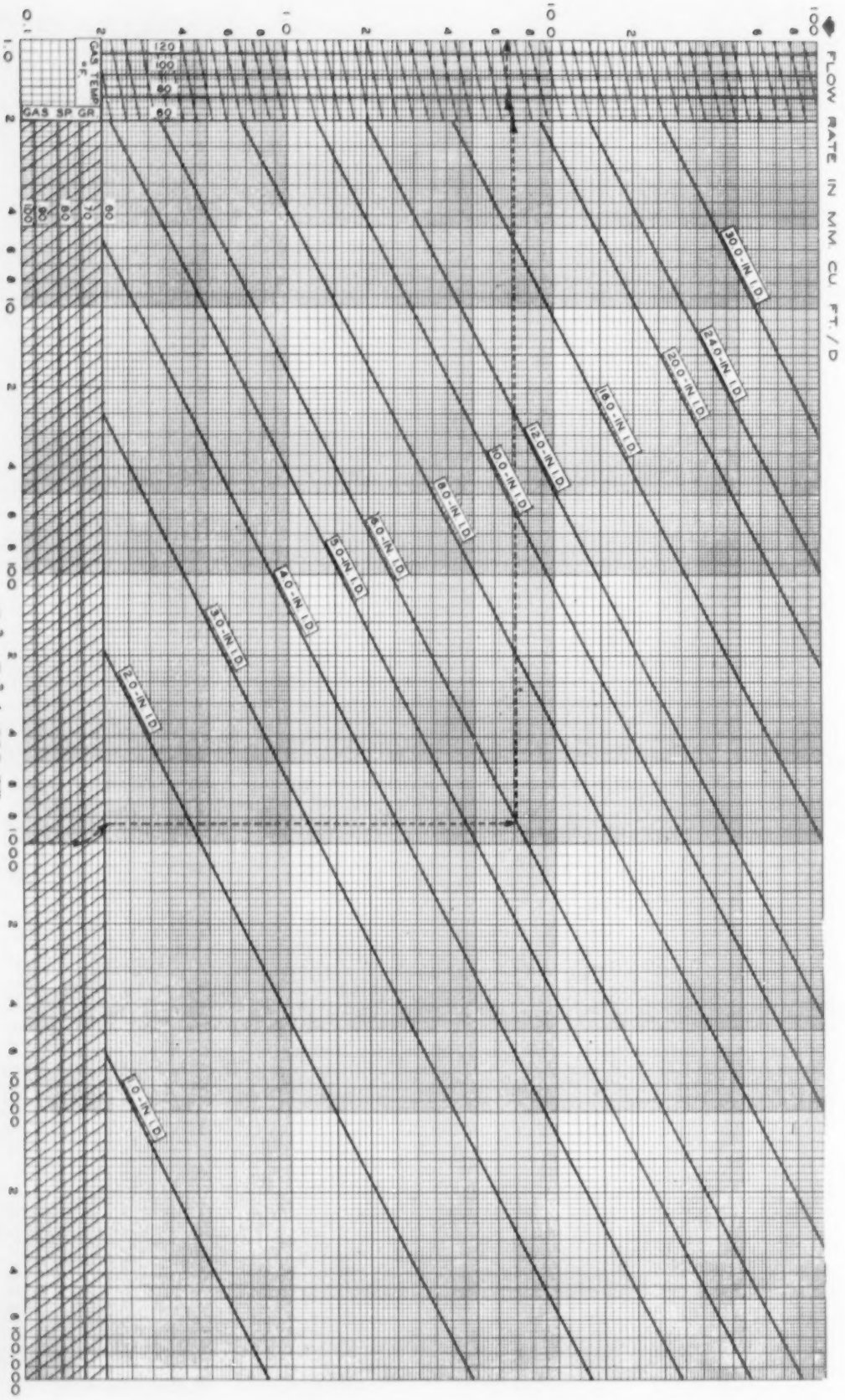

CHART for quick graphical solutions to all types of gas-flow problems. Fig. 1.

which checks close enough with the calculated value.

$$20{,}000 = 198.8 \left(\frac{D^5 \times 295{,}000}{0.70 \times 0.0142 \times 0.89 \times 200{,}000 \times 540} \right)^{1/2}$$

$$= 2.94 \times 10^6$$

and F = 0.0142; Z = 0.89

D = 7.96-in. i.d.

Illustration No. 2 . . . Natural gas with a specific gravity of 0.70 flows through a 6-in. i.d. pipe 83,000 ft. long. Pressure at both ends are 500 and 400 psig., respectively. Average temperature is 80° F. What quantity of gas flows per day?

Solution . . . Viscosity of gas at flowing conditions is 0.0112 cp. and compressibility factor is 0.91. After making a few assumptions, finally the following gives the proper results:

Assume: F = 0.0155

$$Q = 198.8 \left(\frac{7{,}776 \times 83{,}000}{0.70 \times 0.0155 \times 0.91 \times 540 \times 83{,}000} \right)^{1/2}$$

Q = 7,500 M.c.f.d.

Solution by Chart

$$(P_1^2 - P_2^2)/1{,}000 \text{ ft.} = 1{,}000$$

and as it is shown in the chart, it gives the value of:

Q = 6.9 M.M.c.f.d.

upon correction for (Z), it becomes:

$$Q \text{ (actual)} = 6.9/(0.91)^{1/2}$$

= 7.25 M.M.c.f.d.

The value is very close and it eliminates laborious calculations and assumptions.

Illustration No. 3 . . . Twenty million cubic feet per day of a natural gas at 800 psig. and specific gravity of 0.70 is available.

It is required to dispatch it to a locality 200,000 ft. away having pressure of about 600 psig. at the terminal. Design the necessary pipe size for the above conditions.

Gas average temperature = 80° F.

Solution

Viscosity = 0.0120 cp.

After laborious assumption, ultimately the following gave the proper results:

Assume: D = 8.0-in. i.d.

$$\text{Re. No.} = \frac{20.15 \times 20{,}000 \times 0.70}{8.0 \times 0.0120}$$

$$(P_1^2 - P_2^2)/1{,}000 \text{ ft.} = \frac{295{,}000}{200} = 1.475$$

$$\text{Actual } (P_1^2 - P_2^2)/1{,}000 \text{ ft.} = \frac{1.475}{0.89}$$

= 1,660

Now read this value on horizontal axis the same as in the previous illustration; follow the same procedure for 20 M.M.c.f.d. on vertical axis. These two lines intersect at the 8-in. i.d. line which is the answer.

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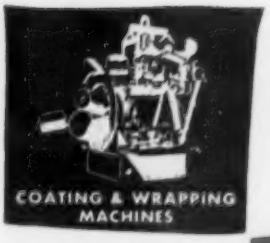
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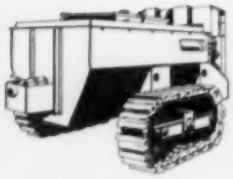
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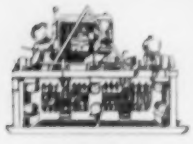
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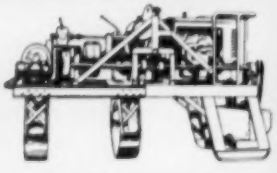
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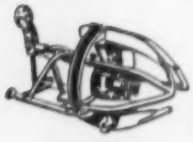
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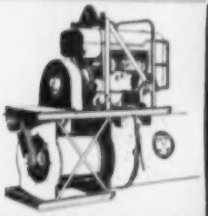
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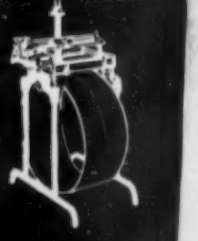
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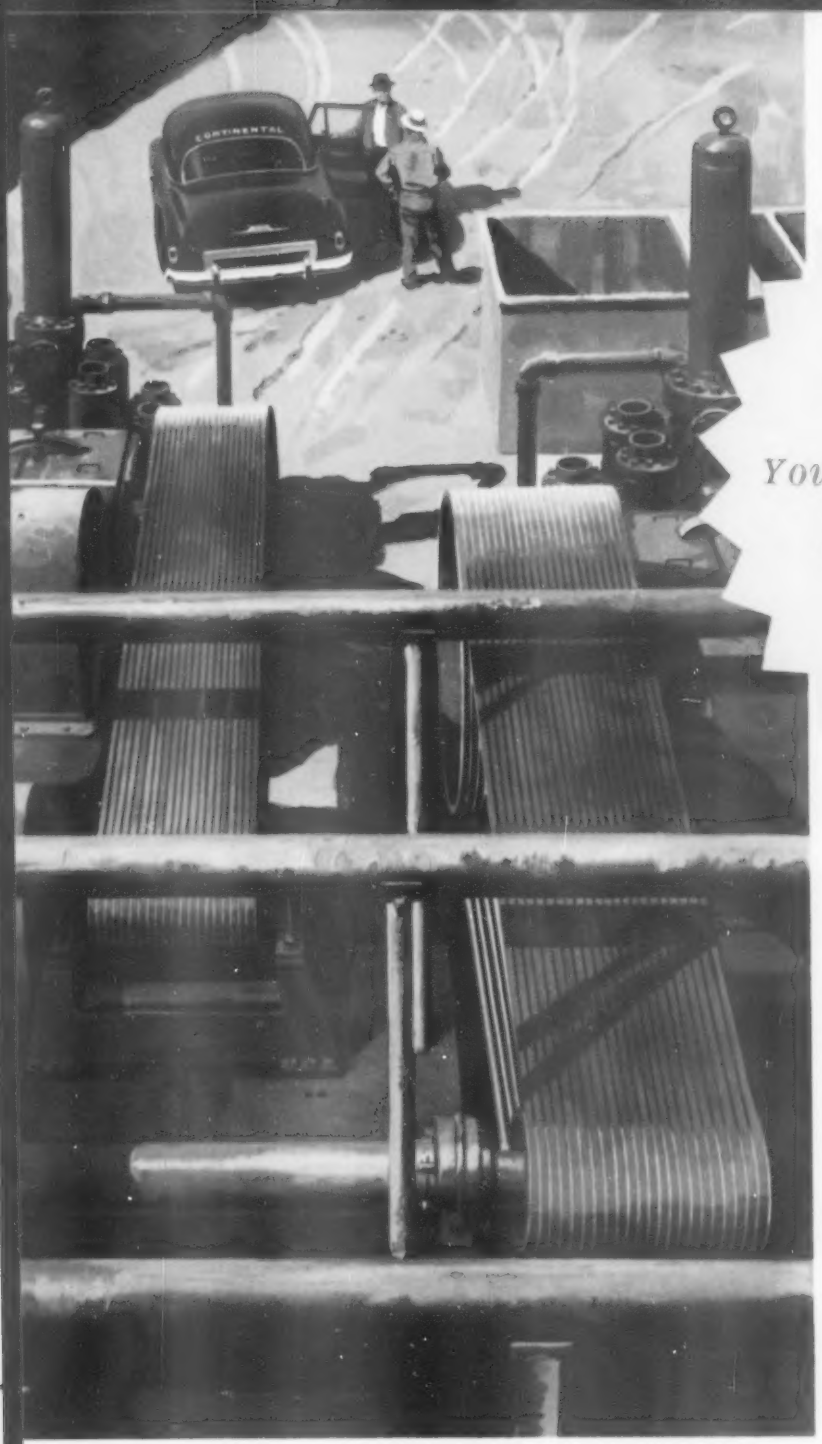

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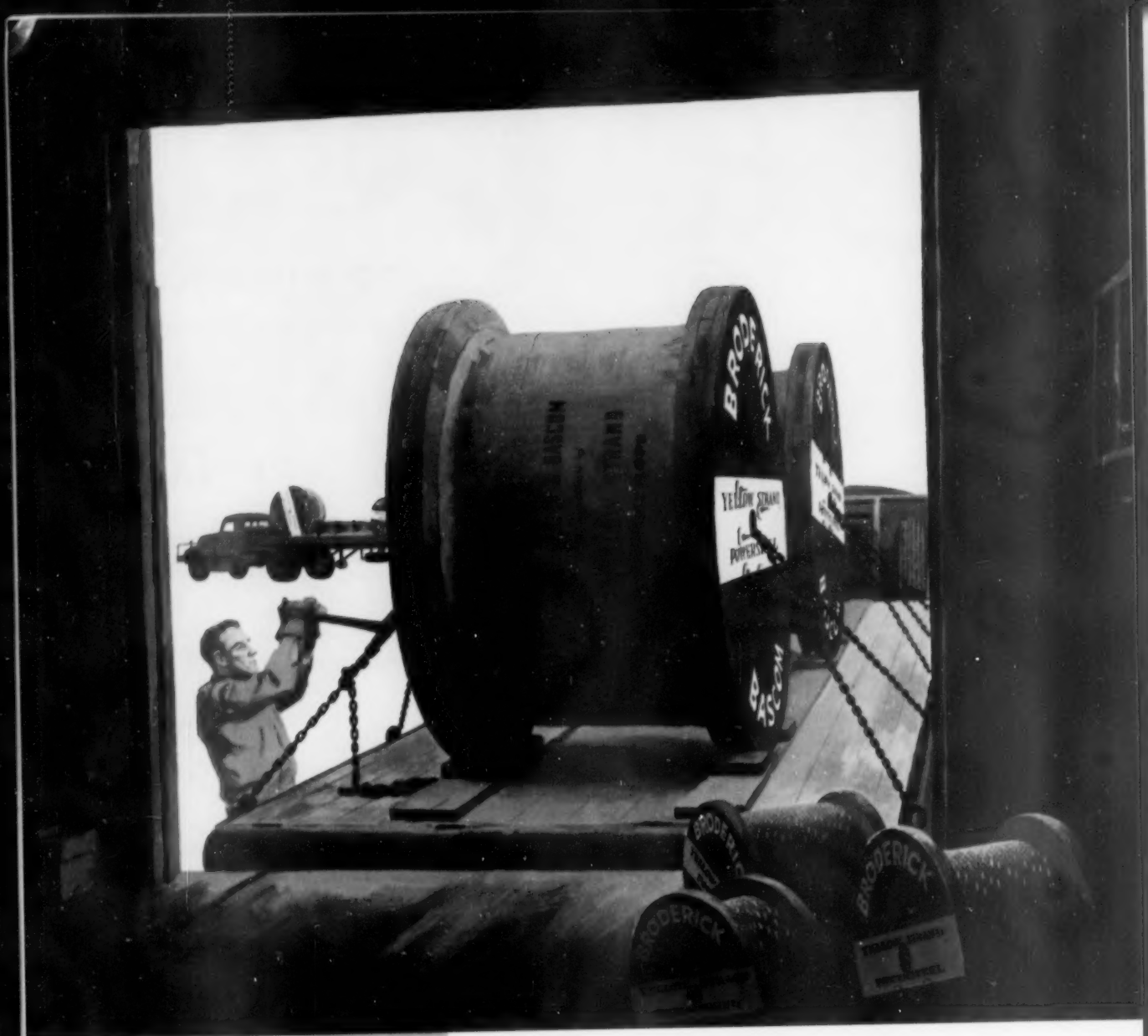

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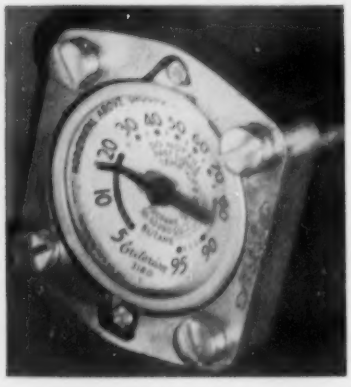
The OIL AND GAS JOURNAL Showcase
.....OF NEW EQUIPMENT



Gage Dial Chamber Housed In Cast-Aluminum Body

This new L.P.G. gage features a heavy-duty dial chamber. Housed in a massive cast-aluminum body, the dial chamber was redesigned to eliminate breakage problems which resulted in transportation or installation in tank systems.

This gage has a recessed dial chamber and a new angle-view dial face. The dial face, arranged for quick, easy, and accurate readings, is removable.

Two small screws, one at the top of the dial chamber, the other at the bottom, makes its removal simple when replacement is necessary. This eliminates the costly time-consuming operation of pumping fuel from one tank to another during a gage change.

The dial chamber is hermetically sealed to insure its being dust-free and water-tight, and the chamber is sealed off from the gage's main mechanism which is float-operated with magnetic drive. **For more information write or call: Rochester Manufacturing Co., 100 Rockwood Street, Rochester 10, N. Y.**

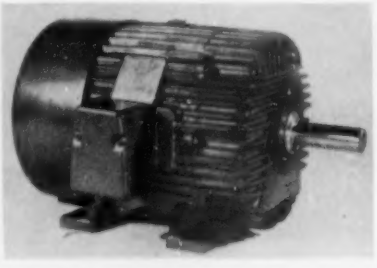
●

Line Heater Gives Flexible Heat Without Electricity

The thermal catalytic duct is a line heater similar to an electric-heated wire and was designed for use in place of an electric heater where electricity is unavailable or uneconomical. This new line heater uses a flexible metal hose in which a catalytic chemical reaction between air and hydrocarbon vapors takes place. These vapors are supplied to the hose by a small pump or blower, power for which is furnished in electrical, chemical, or mechanical form. The reaction in the conductor is repeatable, fully enclosed, and explosion-proof. It may be intermittent or continuous and the heat output can be accurately controlled. The entire mechanism can be permanently installed and after installation it requires no attention other than a periodic addition of a liquid fuel.

The duct may be round or flat or assume any other desired cross-sectional configuration. It can be used straight, coiled, bent or twisted, mounted to a surface, or wrapped around a body. **For more information write or call: Instrumentation Associates, 17 West Sixtieth Street, New York, N. Y.**

●

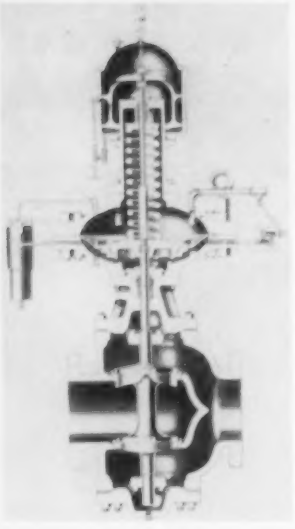


Motor Line Offers More Horsepower in Less Space

Redesigned integral-horsepower induction motors (Type N) in N.E.M.A. frames (up to 30 hp.) are smaller, lighter, and more compact than former models. The conventional open motor is entirely superseded by a dripproof-protected design, which is also essentially splashproof. The new totally enclosed fan-cooled design is a refinement of the ribbed-frame motor.

Insulation of the new motor line takes full advantage of modern synthetics, is high in dielectric strength and resistance to damage from moisture, heat, abrasion, and corrosion.

The standard bearing is an open greaseable design which is enclosed in grease to eliminate corrosion from internal or external moisture. If preferred, prelubricated cartridge-type bearings may be specified. **For more information write or call: Crocker-Wheeler Division, Elliott Co., Jeannette, Pa.**



Regulator Won't Jump on High-Pressure Gas Lines

To solve the problem of vertical instability or jumping that is sometimes encountered on high-pressure gas-transmission lines, a new high-pressure regulator features an oil dash-pot which will dampen out any tendency of the valve to jump, yet will not cause valve to deviate from control point.

Called the Series 883 and 885, these regulators are rugged throughout. Diaphragm casings are capable of withstanding 1,000 psi. Steel loading pilot is suitable for pressures up to 1,000 psi. and has an adjustable reduced-pressure range of 100 to 450 psi. This new series is available in valve body sizes 2 through 12 in. The new regulators have been field tested. **For more information write or call: Fisher Governor Co., Marshalltown, Iowa.**

●

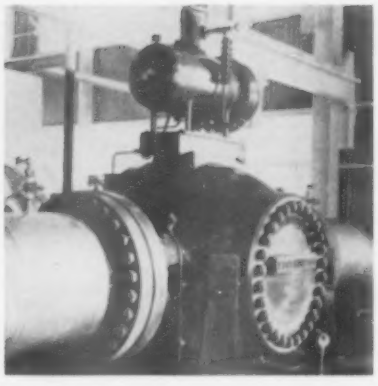
Center Line Compressor Is Field Proven

A new concept in compressor design, the Type GUP Center-Line centrifugal booster has just completed its first 18 months of pipeline service at the Northern Natural Gas Co.'s Macksville, Kans., station.

The gas pipeline compressor has averaged 800 million cubic feet per day at a pressure of 500 psi. Records show that it has required practically no maintenance.

The center line support of the spherical casing has greatly reduced the compressor shaft center-line movement, plus minimizing starting stresses and extending the life of the bearings.

The oil system is completely contained on the compressor base plate



and in console, regardless of whether the compressor oil system is combined or separated from the driver oil system. All oil passes through the compressor-driven high-pressure pump and there is no dependence of the compressor on oil-supply pressure from the driver.

The lightweight impeller and internal parts permit the easy inspection of impeller, seal, and front bearing without having to use removal tools. No internal part is too heavy for one man. Alternate impellers and diffusers can be supplied for field change to accommodate other service conditions. **For more information write or call: Worthington Corp., Harrison, N. J.**

•

Grinder Provides One-Man In-Line Valve Reseating

Through the use of a new high-speed motor and recently developed abrasive-cloth grinding elements, this new motor-driven valve reseater can grind the seat of any valve regardless of material hardness. One man can regrind any globe or gate valve from ¼ to 12 in. without removing the valve from the line. The grinding elements, made in the form of cones and segments, are mounted on various sizes of rubber-coated grinding heads. Since one man grinds the valves in the line, this machine saves the labor of a valve repair and replacement crew. It also cuts down on the replacement valve inventory. The precision-built machine guarantees accuracy by refacing irregular valve seats from the same reference point that was used by the manufacturer in machining the original seat. Strict adherence to the original reference point makes the reground valve as tight as new.

The new valve reseating grinder is available in compact kit form in three basic models for globe or gate valves. **For more information write or call: Leavitt Machine Co., 10 East River Street, Orange, Mass.**

•

Converter Operates X-Y Plotter From Punched Tape

A converter for operating an X-Y plotter from digital inputs, this new instrument operates from a punched-tape reader. The converter is designed to accept data from the output punched-paper tape of the Electrodata Datatron computer, however, it can be modified to operate with any other digital computer furnishing a paper-tape output. If a printed listing is desired in addition to the plot, the unit can be operated from a tape-actuated typewriter.

The main feature of the new converter is that programming need not be specified on the tape. A number of switches on the converter determine the words and digits to be plotted.

Normally, a seven-column paper tape is provided for the converter, however, only four of these are actually used. The tape reader normally operates at 20 characters per second. Maximum plotting speed approaches 40 points per minute.

Accuracy is ± 1 per cent. Over-all accuracy of the system will depend on the sensitivity of the plotter. **For more information write or call: Librascope, Inc., Glendale 1, Calif.**

•

Fluid-Contact Pump Parts Made of Stainless Steel

Available from stock, a new line of centrifugal pumps features the use of Grade 316 stainless steel for all parts of the pump in contact with the solu-

OIL AND GAS JOURNAL Showcase Coupon

USE THIS FORM TO OBTAIN INFORMATION ON ITEM DESCRIBED HERE

MANUFACTURER _____

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Please send me complete information on the following item

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Described in the Sept. 10, 1956, issue of The Oil and Gas Journal

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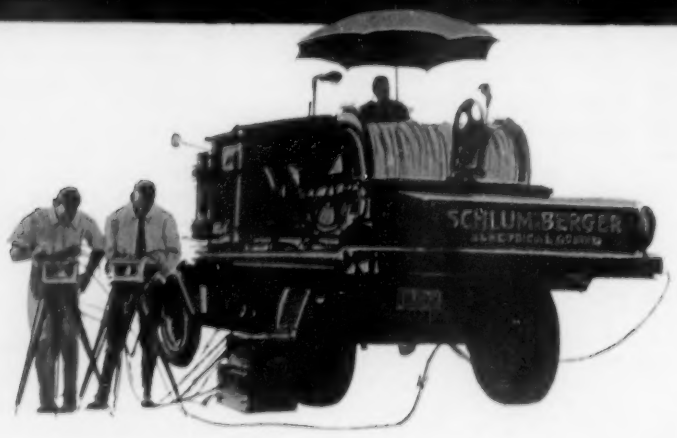

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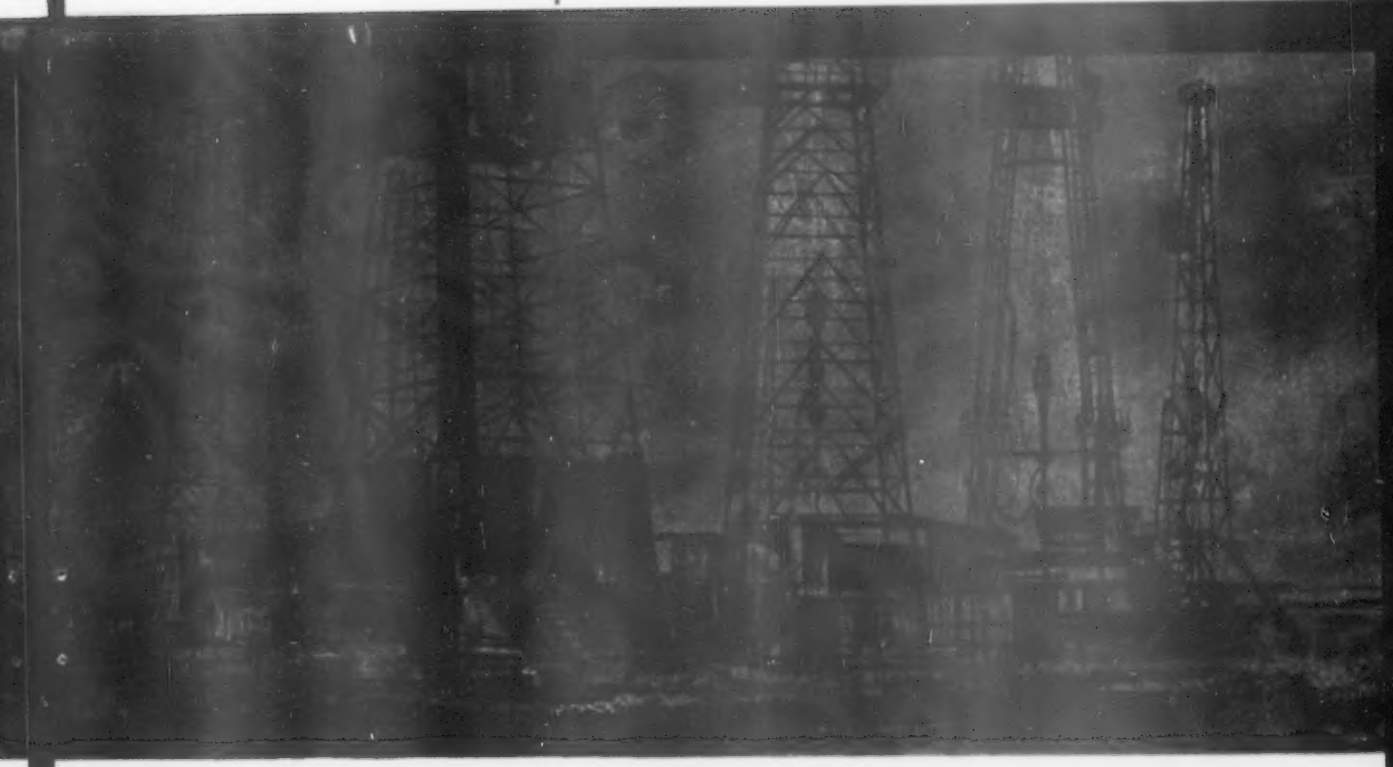

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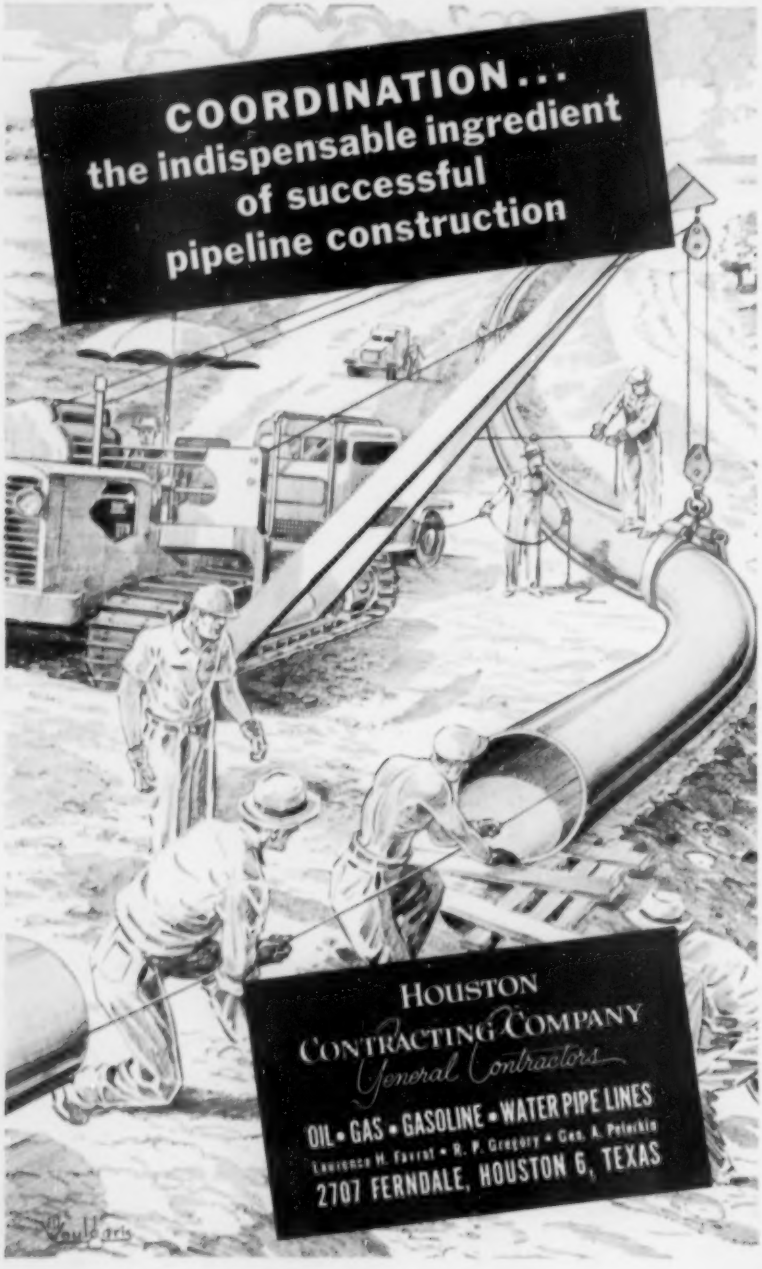
tion. Shafts and fasteners are also of stainless steel. Supporting pedestals, protective shaft sleeves and impellers may be selected from other wear and corrosion-resistant alloys.

The single-stage, single-suction, stainless-steel pump is stocked completely assembled with maximum-diameter impellers and is available with or without base and coupling for N.E.M.A. frame motors. Various deviations from the standard off-the-shelf pumps plus a choice of several accessories can also be supplied. These include: special lubricating systems; hook-type shaft sleeves; extra-rigid shafts; high-capacity double-row bearings; packed stuffing box with several kinds of ceramic and carbon, stellite and carbon, and other combinations. Complete parts inventories will be maintained for both the standard stainless pumps and special accessories for immediate shipment of all repair and replacement parts.

With capacities to 600 g.p.m. and heads to 160 ft., the new pump line offers sizes from 1½ by 1¼-in. to 4 by 3-in. **For more information write or call: Ampco Metal, Inc., 1745 South Thirty-eighth Street, Milwaukee 46, Wis.**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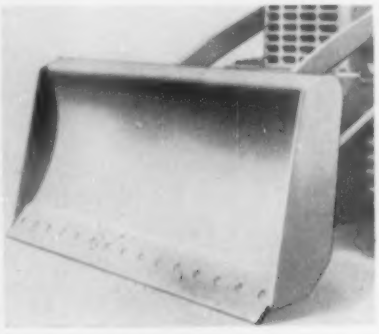

Replacing Bucket, Dozer Blade Levels and Backfills

Designed for the Caterpillar No. 977 Traxcavator, this new 104-in.-wide bulldozer-blade attachment has a straight blade. It is useful for leveling, clean-up, and backfilling operations usually accomplished with the Traxcavator bucket. Its greater width makes it more efficient than the bucket for these jobs.

This new bulldozer attachment fastens to the lift arms with a bracket arrangement at the same point where the bucket connects. **For more information write or call: Caterpillar Tractor Co., Peoria, Ill.**

●

Standardization Is Possible With New Pipe Markers

Plant and maintenance engineers now can standardize the pipe-identification system for entire plants with new self-sticking Perma-Code pipe markers. With pipe identification standardized, tracing pipelines is quick and sure through different rooms, departments, and buildings. Maintenance down-time is reduced, operating errors minimized, and plant safety improved.

The new Perma-Code pipe markers come in stock heights to fit any size pipe. They are made of all-temperature vinyl-cloth with a heavy-duty, all-temperature adhesive, and silicone-plastic overcoated for long life. They are guaranteed to stick to pipes for a minimum of 2 years. Job-tested, bold, black letters on A.S.A. Standard A-13 background colors identify pipe contents with both color and legend. Matching directional arrows indicate flow direction of pipe contents. **For more information write or call: W. H. Brady Co., 727 West Glendale Avenue, Milwaukee 9, Wis.**

VOICE COMMUNICATION
PLUS Control

RFL
Model 983
OPERATES OVER WIRE CIRCUIT OR MICROWAVE

Voicon®
VOICE plus CONTROL
Terminal

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Provides two, reliable frequency shift control channels at 2800 & 3000 cps isolated from voice by filters. Isolation transformers allow connection to balanced wire circuits. Interchangeable plug-in components and printed circuit boards are used in transmitter, receiver and power supply sections.

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OIL AND GAS JOURNAL
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Crescent Armored Multitube System. Covering cabled tubes for instruments and controls, Bulletin 356 gives complete information on various types of Multitube and methods of installation. Illustrations show regular copper and polyethylene tubes, as well as four different corrosion-resistant types. The 12-page, 2-color bulletin describes the relatively new method of utilizing armored-cable instrument tubing to provide better protected instrument lines at substantial saving in cost. Detailed data is provided on standard armored Multitube, and specific instructions given for handling under all possible conditions. **For more information write or call: Crescent Insulated Wire & Cable Co., Trenton, N. J.**

•

Jet-Tray Deaerator. Publication 4651 describes a deaerator design that eliminates tubular vent condensers without impairing efficient purging of noncondensible gases. This type deaerator handles a wide range of operating conditions and provides maximum effective scrubbing contact between steam and water, thus assuring highly efficient oxygen removal. **For more information write or call: Cochrane Corp., Seventeenth Street below Allegheny, Philadelphia 32, Pa.**

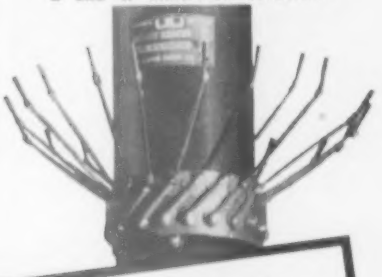
•

Manhole and Handhole Fittings for Tanks and Pressure Vessels are described in a new bulletin. Available in a wide variety of sizes, shapes, and specifications, these manhole frames and covers meet Underwriters Laboratory requirements for use on storage tanks containing hazardous liquids, either above or under ground. **For more information write or call: The Colorado Fuel & Iron Corp., 575 Madison Avenue, New York, N. Y.**

•

Chemical-Resistant Coatings, a new four-page, illustrated bulletin, describes three general classes of chemical-resisting organic coatings developed to meet the needs of processing industries. The three classes are (1) Ucilon coating systems applied like paint for

B and W Multi-Flex Scratcher



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Why be satisfied with an *approximate* reservoir evaluation when Johnston Testers enable your engineers to see the true picture?

The Tension Type Pressure Recorder used in conjunction with Johnston Formation Testers is so sensitive that it faithfully records pressure changes of as little as 5/100 of 1 per cent! Yet it is as rugged as a tool joint.

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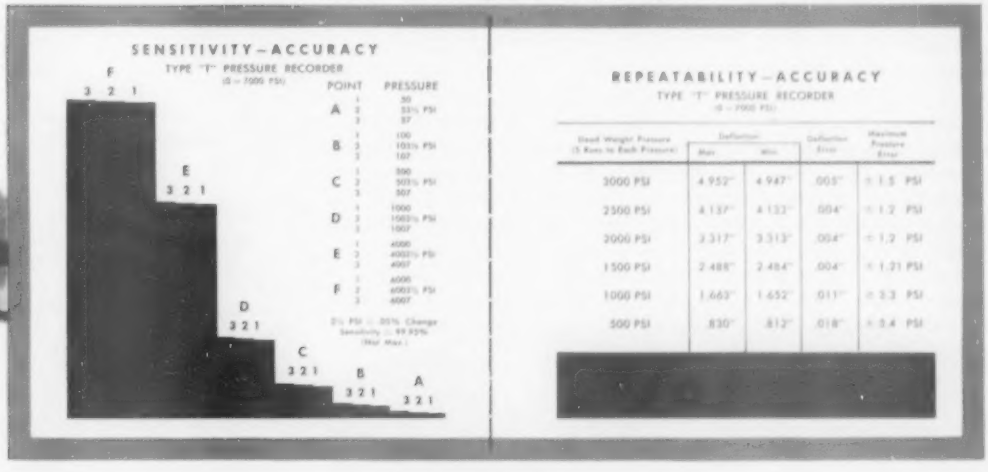

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New R-P&C Bronze Globe Valve

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—FULL-PLUG FOR CLOSER REGULATION, LONGER LIFE

R-P&C's new Fig. 427-DP bronze globe valve is recommended for steam, water, oil and gas service where control or regulation of flow is required. Its 500 Brinell stainless steel seat and disc resist wire-drawing—make it particularly suitable for continuous throttling and other severe applications.

• The Fig. 427-DP is packed with the quality features that users expect from R-P&C. For example, the union bonnet for added strength and convenience, and a disc and seat ring construction which permits regrinding without removing the valve from the line. The full-plug construction, with its exceptional wide seating surface, gives closer control, longer life.

• The Fig. 427-DP is rated for 300 lbs. Steam—1000 lbs. OWG in sizes ¼" to 2", and 600 OWG in sizes 2½" and 3". Also supplied as an angle valve. Precisely designed, it is a fitting addition to R-P&C's complete line of bronze valves—gates, globes, angles and checks, in pressure classes from 125 to 300 lbs. See your R-P&C Distributor or write for catalog.

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general corrosion control; (2) Unichrome plastisol compounds for heavy-duty service, and (3) Unichrome special materials for lining steel drums and tanks. Bulletin Chem C-2 describes Unichrome 4000 series plastisols for dip application, Unichrome 5300 series for spray applications, and the recently introduced Unichrome Super 5300, which is a sprayable plastisol that permits coatings up to 60 mils thick in a single application. The publication points out the advantages of both phenolic Unichrome tank linings and plastisol Unichrome linings. It also describes basic types of vinyl, phenolic, epoxy, and plastisol drum linings. **For more information write or call: Metal & Thermit Corp., Rahway, N. J.**

•

Otis Calipers for Surveying Tubing and Casing for Internal Corrosion. Offering a corrosion-survey service, this one-page, two-color leaflet explains how information is obtained on internal corrosion of tubing in a gas or oil well without killing the well or pulling it. A survey can also be made on pipe on the rack. A copy of the chart of corrosion is included in the well-tubing report. **For more information write or call: Otis Pressure Control, Inc., Caliper Division, 2402 Broad Street, Houston, Tex.**

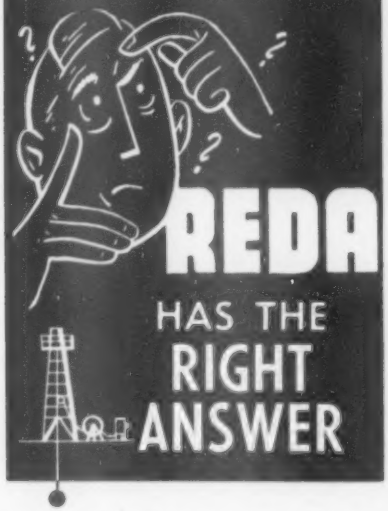
•

Motor Drives With Positive Pulley Adjustment, ranging from ½ to 25 hp., is the subject of the new eight-page Bulletin 1610-B1 P. It contains information on how to select variable-speed drives to meet specialized requirements. It describes engineering features, remote controls, separate motor drive, and other mechanical-power transmission products. Equipped with mounted hand-wheel for fingertip speed control, these motor drives are available with explosionproof motors and can be mounted on the floor, wall or ceiling. The drive features positively adjusted variable-pitch pulleys. **For more information write or call: Worthington Corp., Harrison, N. J.**

•

Tube Cleaners, Tube Expanders, Maintenance Tools are described and illustrated in Bulletin 58. Presenting eight pages and two colors, this brochure uses photographs and tables to describe the cleaning equipment. Eight models of boiler-tube cleaners, three types of heat-exchanger and condenser-tube cleaners, and seven models of tube expanders are featured. The bulletin also covers drills, brushes, special tools, and accessories. **For more information write or call: Airetool Manufacturing Co., Springfield, Ohio.**

HOW to increase production? Lower Cost?



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Reda Pumps are used as original equipment, or replacement equipment, because they produce at a lower cost per barrel of fluid. Whether it's large volumes from shallow depths, or modest volumes from great depths, Reda Pumps provide operating savings.

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Constant research and design improvement are responsible for lengthened operating life, corrosion resistance, low labor cost per barrel of fluid produced.

IMPROVED EFFICIENCY:

Greatly improved overall efficiencies have improved Reda performance as much as 25%; a substantial operating saving.

If you have a pumping problem, our engineering staff is always ready to assist you. Phone or write:

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THIS battery of "Automatic" Sprinkler SUPROTEX-DELUGE valves is assurance of intensive fire-fighting power for this fluid catalytic cracking unit.

Heat-sensitive Rate-of-Temperature-Rise detectors, located throughout the superstructure of the plant, feel fire at inception. Then, in but a matter of seconds, scientifically engineered "Automatic" FIRE-FOG systems take over. Alarms sound, location of the blaze is determined, and fire control or extinguishment is an instantaneous accomplishment.

FIRE-FOG is but one of many advanced types of ENGINEERED Special Hazard PROTECTION developed by "Automatic" Sprinkler Corporation of America. Research into the cause of disastrous fires, endless testing, and much practical field experience has enabled us to design, manufacture, engineer and install the specific type of protection needed to combat every fire hazard. Fixed piping systems of "Automatic" Sprinklers, water spray, high and low pressure CO_2, Air Foam, Dry Powder and Chemical Foam stand guard over leading petroleum and chemical processing properties throughout the Western Hemisphere.

Our highly trained staff of Special Hazard engineers will gladly assist you in the development of a fire-safe, investment-saving future for your business. Write or call us for service today.

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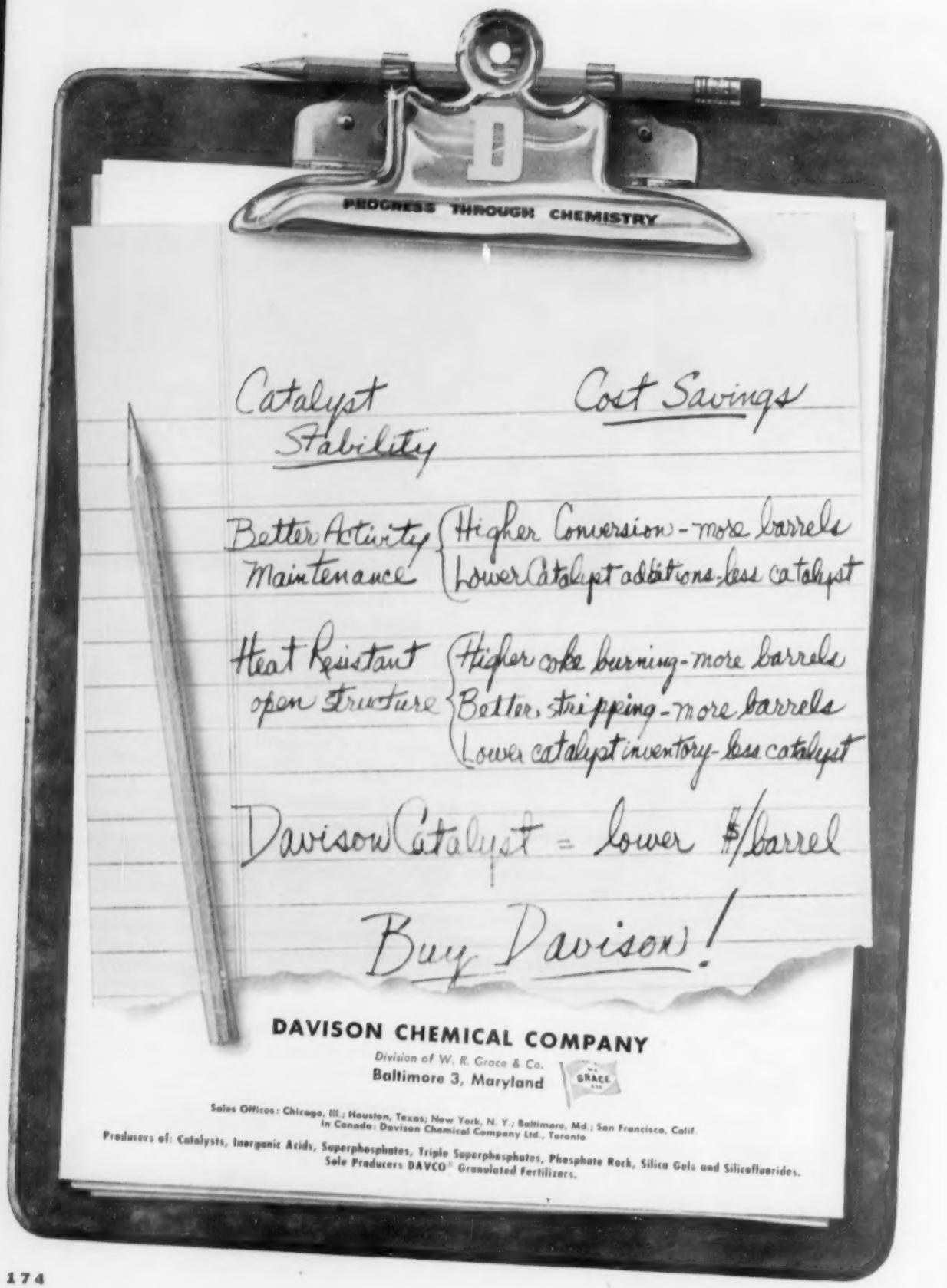
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EQUIPMENT MEN . . . in the News

Dresser Industries, Inc., Acquires Guiberson Corp.

H. N. MALLON

Dresser Industries, Inc., manufacturer and supplier of equipment and technical services for the oil, gas, and chemical industries, has completed negotiations for the acquisition of the assets of Guiberson Corp. of Dallas. Guiberson is a leading manufacturer of oil-well production and drilling equipment.

H. N. Mallon, president of Dresser, in commenting on the acquisition, stated, "The Guiberson Corp., founded in Dallas in 1919 by S. A. Guiberson, Jr., and his two brothers, N. G. and W. R. Guiberson, has a long record of outstanding service to the oil industry. The company has grown rapidly throughout the world and is now completing its third major expansion of recent years. As a member of Dresser Industries, further growth is assured and Guiberson can be expected to make an important contribution to Dresser's sales and earnings in the years ahead." J. B. O'Connor is executive vice president of Dresser Industries.

H. S. ZANE, JR.

J. B. O'CONNOR

No change in Guiberson personnel or general policies is contemplated. Gordon G. Guiberson, president of Guiberson, will become a member of Dresser's board of directors. Other Guiberson executives and officers in Dallas are: A. P. Smith, vice president and general manager; Harry S. Zane, Jr., vice president and sales manager; W. R. Guiberson, vice president; William F. Neal, vice president; C. H. Ballard, comptroller-treasurer; A. J. Wallis, secretary; Tom Losey, chief engineer; P. F. LaRoche, general plant superintendent; and William Horn, rubber plant superintendent.

Nelson Completes Move Into New Plant

Nelson Electric Manufacturing Co., Tulsa, has moved into its new $1,000,000 plant. It is a fireproof building using prestressed concrete beams and roof slabs. Other features include railroad siding running into the plant for ease in loading and unloading freight cars; a high center bay in the assembly plant with a 10-ton traveling crane; a leveling floor for the assembly of switchgear; and a special mezzanine section which houses all production-department offices overlooking the entire assembly area.

Guiberson's history dates back to 1910 when S. A. Guiberson, Jr., entered into an agreement with W. H.

G. G. GUIBERSON

A. P. SMITH

Mills for the manufacture of what was later known as the Guiberson casing tong. A short time later he acquired rights (outside of California) to the Baker casing shoe. In 1913 he entered into an agreement with L. L. Richard for exclusive rights on the automatic tubing catcher, and later an agreement with M. H. Whittier who invented the rotary tool joint. These four famous tools formed the nucleus for the business which later developed into Guiberson Brothers, and in 1919, became The Guiberson Corp.

Equipment now manufactured and distributed by Guiberson and widely used in important oil-producing worldwide areas includes casing and tubing swabs, molded rubber products, well-servicing equipment, drilling heads, gas-lift valves, and related items.

J&L Supply Names Douglas To Tulsa Sales Staff

The recent appointment of William M. Douglas to Jones & Laughlin Supply Division's sales staff in the Tulsa general office has been announced by W. L. Wolfe, vice president of sales.

Douglas, formerly district sales manager of the Muskogee, Okla., district, now closed, will concentrate on petrochemical, refinery and allied industrial trade sales in the Tulsa and northern Oklahoma area.

Douglas has been located at Muskogee since he joined the firm in 1944 and has served as field salesman, sales manager, and district sales manager.

W. E. Evans Heads GE's New Microwave Office

General Electric Co. has established a new microwave sales office in Kansas City, Mo., and has appointed Wayne E. Evans, formerly of the company's communication equipment headquarters staff, Syracuse, N. Y., to head the office.

Evans will serve as district sales manager for General Electric microwave equipment.

McCullough Announces Eastern Division Changes

Bruce January, Lawrence J. McNeeley, Berton Lary, Robert L. Picou, Don P. Collins, and G. W. Rector have been appointed sales engineers at Houston, El Campo, Guymon, Houma, Healdton, and Carmi for McCullough Tool Co. These personnel changes in the company's eastern division were announced by O. J. McCullough, vice president of the company.

January has served as branch manager and salesman at El Campo. McNeeley who joined McCullough in 1951, was operating engineer at Beau-

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ELECTRONIC PROCESS CONTROL SYSTEM

'American-Microsen' presents a new all-electronic process control system with...

Transistorized instruments.

All measurement and control functions contained in just three basic units.

Each unit contained in a single, compact housing.

The *transistorized* electronic Controller has all control room components within one, panel-mounted case. *Transistorized* for highest reliability and compactness, this new instrument saves both panel space and wiring... means better process control for a smaller investment.

For transmission, control and valve operation based on the proved 'American-Microsen' System, be sure to visit:

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Manning, Maxwell & Moore, Inc.
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New York Coliseum
September 17-21, 1956

THE TRANSMITTER

The new Series 185 Pressure Transmitter is a miniaturized version of the well-known 'American-Microsen' Pressure Transmitter. It incorporates the latest mechanical and electrical features to achieve maximum operating benefits and usefulness.

The time-tested "Microsen" balance creates a stable dc signal for long distance transmission. Bearing pivots and linkages are entirely eliminated. Consequently, sensitivity is practically infinite, and repeatability of measurement is within 0.001% of range span.

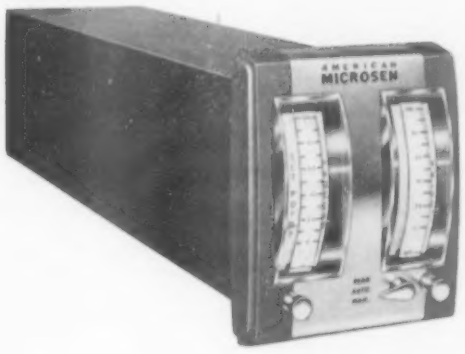
Printed circuitry and miniaturized components reduce the size of the transmitter to only 4⅞" in diameter and 5¼" high. In dust and weatherproof case designed for universal mounting, the Series 185 can be firmly supported on meter piping, pipe pedestal or vertical surface.

'American-Microsen' Transmitters of similar design are available for differential pressure, flow, temperature and other variables.

MANNING,

MAKERS OF 'AMERICAN-MICROSEN'

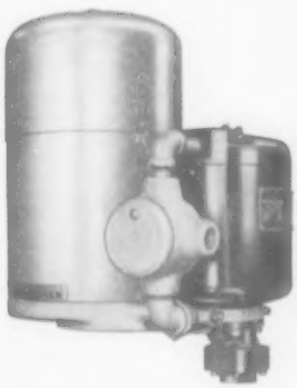
THE CONTROLLER



The Series 164 Controller provides a complete controlling system in a single panel-mounted housing. Now one compact transistorized unit handles *all* control functions: indicating or recording the process variable, controlling, and manual-automatic operation. Transistorized design greatly improves reliability and service life. Savings in panel cost are tremendous because of miniaturization and consolidation of control functions – because no longer is it necessary to wire several units externally.

The Series 164 is available as a Recording Controller, compact Indicating Controller and as a long-scale Indicating Controller. Each functional unit is contained on a separate plug-in chassis within the housing. Each unit can be removed and replaced within moments without disturbing the operation of the other units.

THE OPERATOR



In 1955 we introduced the 'American-Microsen' Electro-Hydraulic Control Valve Operator – a power unit with position feedback to operate control valves, dampers, etc. It completely eliminated the need for compressed air.

More than a year of efficient performance in field service was paralleled by further engineering developments that culminated in the new Series 181 Electro-Hydraulic Control Valve Operator. This improved unit offers simplified design characteristics that mean even lower cost and greater reliability than its predecessor.

The Series 181 Electro-Hydraulic Control Valve Operator is mountable on standard yokes supplied with conventional slip-stem control valves with bodies of single or double-seated construction, with V-port, parabolic, needle and equal-percentage plugs. It can be furnished for all valve sizes, including those of 4" stroke, and with force available up to 3,250 lbs.

MAXWELL & MOORE, INC.

INDUSTRIAL CONTROLS DIVISION

Stratford, Connecticut

ELECTRONIC INSTRUMENTS FOR MEASUREMENT, TRANSMISSION AND CONTROL

mont, prior to his promotion. Lary started with McCullough 5 years ago.

Picou has had 6 years' experience as an operating engineer. Collins spent 7 years on rotary rigs in southern Oklahoma before joining McCullough in 1953. Rector worked for several drilling companies before joining the McCullough company.

Globe Oil Tools Appoints Wardle and Gormley

Lee Wardle has been appointed vice president and general sales manager of Globe Oil Tools Co., according to Charles E. Whittaker, president. Gene Gormley, who has been a salesman at the Bakersfield branch, is being assigned as the regional manager of California, Rocky Mountain and Canadian territories.

LEE WARDLE

GENE GORMLEY

Misco's New Quarters to Speed Customer Service

This modern new building at a more convenient location in Independence, Kans., has broadened Mountain Iron & Supply Co. service in southeastern Kansas and northern Oklahoma.

Personnel at the store includes M. M. (Mac) Crossfield, store superintendent; F. L. Robinson, field salesman; and Bill Troutman, store manager. Crossfield has been the superintendent of the Independence store since it was first opened.

The functional building was designed to give expeditious handling of the customer's needs. All pipe racks are truck-bed height for ease in loading and unloading. The store has a rear entrance to facilitate material handling. Roads around the yard and the store are of all-weather construction. The store maintains a complete stock of oil-field supplies including line pipe, tubing, casing, engines and American, Allen and Jensen pumping units.

Lehner Named SSC's West Coast Representative

Francis M. Lehner is Seismograph Service Corp.'s new West Coast representative and will work out of the firm's offices in Bakersfield, Calif., according to an announcement by G. H. Westby, president of SSC.

Lehner joins Savino Giacomelli, chief logging engineer, who has been in charge of the office and carrying double duties as engineer and representative.

Lehner formerly was a seismologist with Shell Oil Co.

Fluid Packed Pump Names Product-Development Mgr.

P. S. BLOUDOFF

Peter S. Bloudoff has been appointed to the newly created position of manager of product development for Fluid Packed Pump Co., according to John Brennan, chief engineer. Besides new-product development, Bloudoff's duties include the improvement of existing products and technical assistance to Fluid Packed Pump's field and manufacturing organizations on all Oilmaster products and applications.

Bloudoff was formerly with Axelson Manufacturing Co.

Oilwell Appoints Two, Opens West Texas Stores

Appointment of Grover H. Huffines as assistant district engineer, machinery and equipment sales at Midland, Tex., and naming of Clifford Wallace as field representative at Sweetwater, Tex., for Oil Well Supply Division of U. S. Steel Corp., have been announced by William Miskimins, manager of Oilwell's Central Midwest area.

Oilwell also announced the opening of two new stores in West Texas. C. E. Lewis has been appointed store manager of a new store at San Angelo. The store is in the division's West Central district, of which J. H. Fenton is

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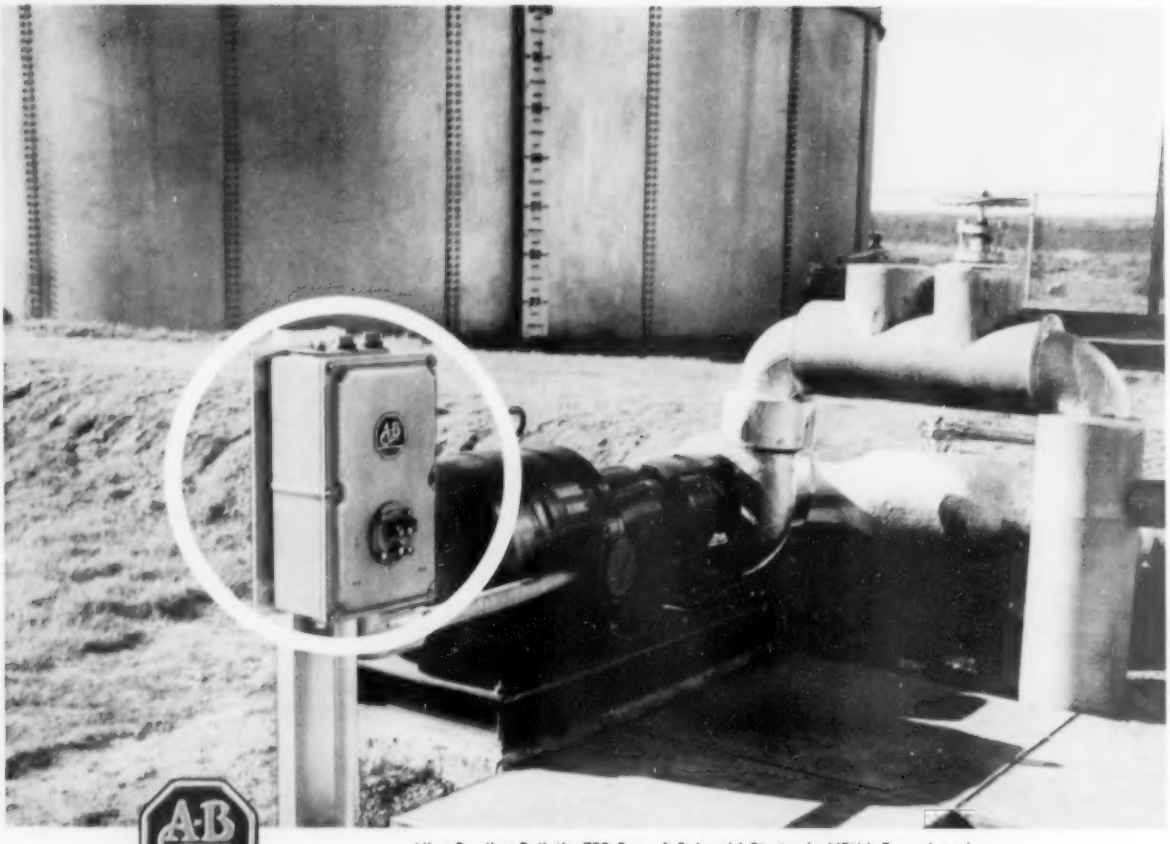
TULSA: SHREVEPORT: GREAT BEND: CASPER: NEW ORLEANS: CENTRALIA: DALLAS: HOUSTON: MIDLAND: PITTSBURGH
EXPORT OFFICE: Room 624, International Bldg., 630 5th Ave., New York 20, New York
FOREIGN LICENSED MFR.: Oil Well Engineering Co., Ltd., Cheadle Heath, Stockport, England



Allen-Bradley Bulletin 709 Form 1 Solenoid Starter in NEMA Type 4 enclosure with watertight push buttons for use with pump.

The Sign of
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Motor Control

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NEMA 8
For Hazardous
Gas Locations

NEMA 4
Watertight

NEMA 9
Dust-tight

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For Hazardous
Gas Locations

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Corrosion-proof

When "safety" calls for bolted enclosures use Allen-Bradley maintenance free Solenoid Starters

In the petroleum industries, Allen-Bradley trouble free solenoid motor starters are providing continuous service under all conditions . . . without interruption for contact maintenance.

Their simple solenoid construction—with only ONE moving part—assures you of years of trouble free operation.

Bolted enclosures for hazardous locations present no service problems with Allen-Bradley starters, because their double break, silver alloy contacts never need filing, cleaning, or dressing . . . they are always in perfect operating condition.

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SOLENOID MOTOR CONTROL
QUALITY

manager. The second store will be opened at Kermit under the management of W. B. Potts. This unit is located in the West Texas district, of which S. E. Snow is manager.

Huffines joins Oilwell with 19 years of experience in sales work. Wallace was promoted to his new post from Albany, Tex., where he has been located since he joined the division in 1952.

Cardinal Adds Liggitt to Great Bend, Kans., Sales

The addition of R. L. (Dick) Liggitt to the sales staff at Great Bend, Kans., has been announced by Cardinal Chemical Co., Odessa, manufacturer of Nocor corrosion inhibitors.

Cardinal sales are currently represented at Great Bend by Sam Brinnell. Liggitt will work north from Great Bend, Brinnell south.

CSI Adds Smith to Engineering Staff

R. M. (Randy) Smith has joined the engineering staff of Corrosion Services, Inc., Tulsa. The announcement was made by Yale W. Titterington, CSI general manager. Smith will assist in the designing of cathodic-protection systems for pipelines, oil-well casing and similar uses.

Smith was formerly senior corrosion engineer with Great Lakes Pipe Line Co., Des Moines, Iowa. While with Great Lakes, he worked on cathodic-protection problems on pipelines throughout the Midwest.

Failing Appoints Two as Foreign Representatives

The appointment of E. E. Andreason and E. R. Lundberg, of New York City, to handle foreign business for George E. Failing Co. of Enid, Okla., has been announced by E. A. Johndrow, Failing vice president of sales. The Failing company, a subsidiary of Westinghouse Air Brake Co., manufactures portable rotary rigs.

Andreason and Lundberg were associated with the late George P. Gregory, former Failing foreign sales representative. In the picture, Lundberg is on the left, Johndrow in the center, and Andreason on the right.

Lane-Wells Elects Ingle, Promotes Walsh, Miller

L. H. INGLE

L. H. Ingle has been elected treasurer of Lane-Wells Co., according to John J. Neale, president. With Lane-Wells since 1945, Ingle has been chief accountant, assistant controller, and controller. Robert L. Walsh, who has been with Lane-Wells since 1940, has been advanced from chief accountant to assistant controller. F. E. Miller, with the company since 1949, replaces Walsh as chief accountant.

Allis-Chalmers Appoints Baseheart and Borwell

J. C. Baseheart is engine sales manager, and F. M. Borwell is assistant engine sales manager of the Buda division, tractor group, Allis-Chalmers Manufacturing Co., with headquarters at the home office in Milwaukee.

Baseheart was in charge of engine sales and Borwell was special district representative, engine sales, for the Buda division, Harvey, Ill.

CORROSION CONTROL IS A YEAR-ROUND JOB

Chromates never take a vacation from their work in controlling corrosion. There is never a seasonal lay-off for these effective inhibitors. Summer, winter, fall and spring — chromates continue to be essential in efficiently protecting such equipment as cooling towers, evaporative condensers, air conditioning units, diesel engines, automobile radiators, boilers, pasteurizers, freezing plants, ice cans, and ammonia absorption systems.

But there is a way for you to take a vacation from your corrosion problems. Let Chromium Chemicals do the job. Mutual, a dependable source of supply for the highest quality Chromium Chemicals, will be glad to help you decide which is the best chromate to fit your requirements.

SODIUM BICHROMATE CHROMIC ACID SODIUM CHROMATE
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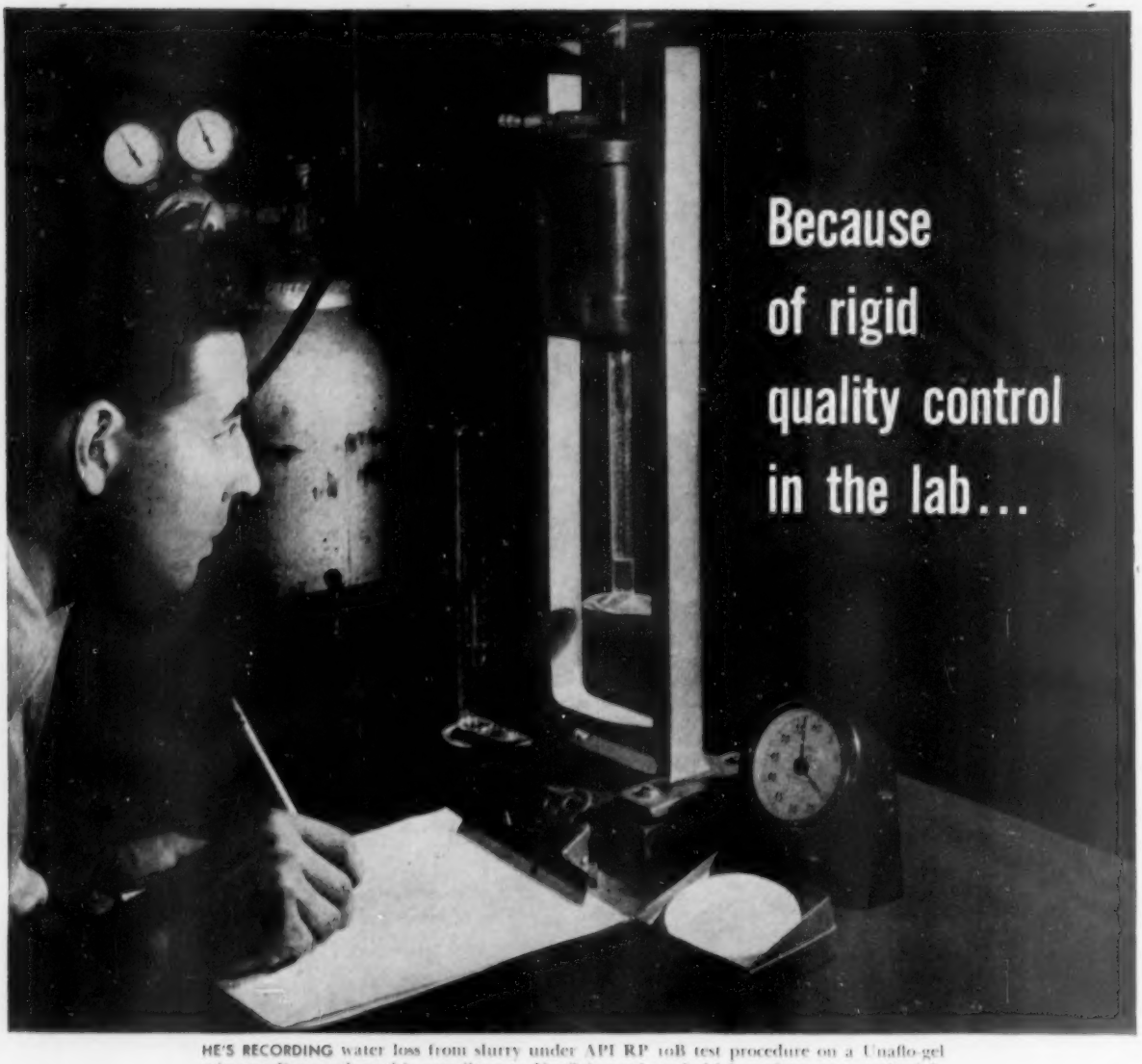

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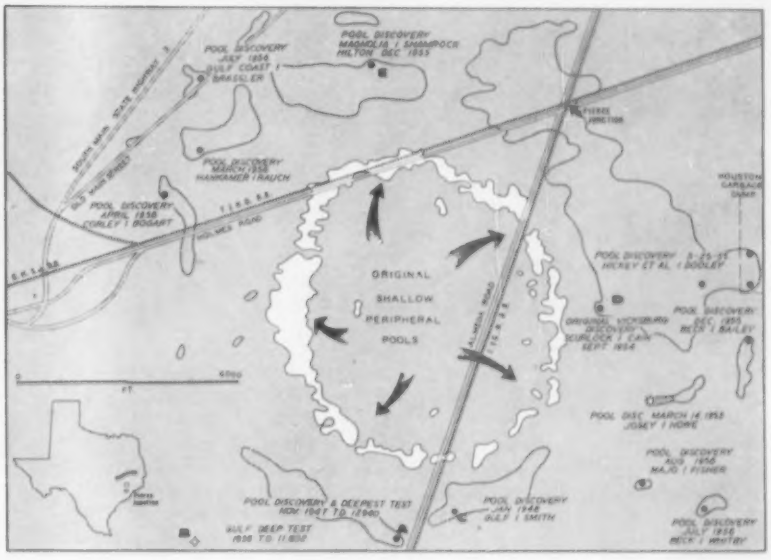


PIERCE JUNCTION FIELD, Harris County, Texas, is the scene of the most active development campaign in the coastal region since discovery of deep outlying pools in Vicksburg sands at 6,900-8,100.

FORMULA 209 . . .

A recipe for oil finders

by Frank J. Gardner

EVER had an oil pie? The idea may not stimulate your appetite, but it's certainly great for the pocketbook. Oil operators in and around Houston these days are slicing up a fine one right on the southern city limits.

The shaded pool outlines on the map above are surface outlines and do not reflect the complex pie-shaped fault blocks that ring the northern half of the old Pierce Junction salt dome; a recent subsurface structure map reveals at least 44 separate "slices" so far delineated in that semicircle. And 20 different operators are keeping 31 rigs busy looking for more.

Glamor and garbage . . . This development campaign on the flanks of Pierce Junction is the largest concentrated field program in the entire coastal region, and the biggest news of the year for the Houston area. It has had its flashes of glamor and garbage, its publicity and politics — this largely because of its location—but its exploratory significance should not be lost in the rush.

For here is just another case in point to support those few aggressive salt-dome enthusiasts who have preached for years that Gulf Coast operators were neglecting vast oil potentials right in their own backyard. The fact that Pierce Junction is literally in their backyard has helped to dramatize the point for Houstonians, all of whom will share in the benefits from two wells just finished on the city garbage dump (east side of map). If you multiply the impact and importance of Pierce Junction by 209, you can get an idea of what these salt-dome sages mean when they state flatly that "the prospective and potential areas yet to be explored . . . are much larger in extent than the entire previously known domal area."

For there are 209 known piercement salt domes in the Gulf Coast region; of these, only 111 have produced oil or gas. On the rest of them, little or no work has been done, and on most of them, no drilling or study is going on at all. That figure of 111, by the way, includes 3 that have produced for the first time within the past year, another indication of progress in a promising field of exploration. These recent events, at Davis Hill (Liberty County), at Hainesville (Wood County), at Bethel (Anderson County), and now at Pierce Junction, must surely impress upon oil finders everywhere the tremendous future importance of those 209 salt domes.

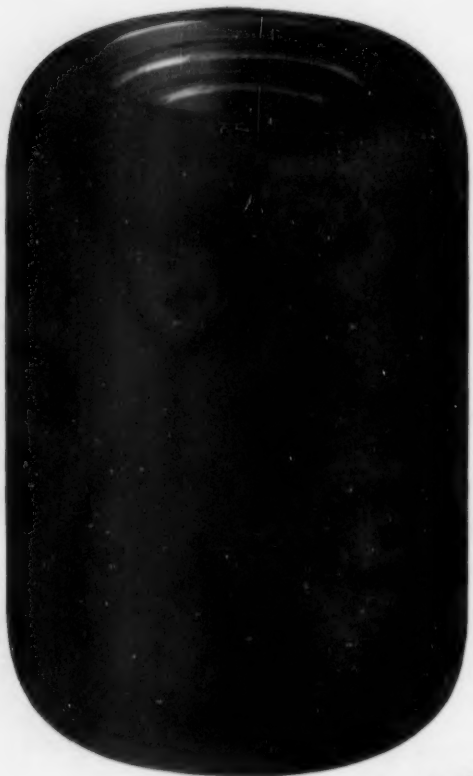
To find this undiscovered oil, geologists will have a selling job on their hands. Three years ago, no operator in his right mind would have considered drilling the garbage dump. Today he'd jump at the chance. That's hindsight. But he must be sold on foresight through sound, serious imaginative subsurface salt-dome study; such study will produce the ammunition to sell these prospects to management. Obviously, judging from events of the past year, some of this is already going on. But it must be multiplied by 209.

On an ancient dome . . . Pierce Junction is a prime example of what can happen. It was known to be a salt dome in 1901; the usual signs revealed it—gas seeps, paraffin dirt, and slight domal surface elevation. It produced no oil until 1921 when Gulf Oil Corp. finished its 2 Taylor and launched the development of the typical halo of Mio-Oligocene pools around the dome periphery. Actually, the "deep Vicksburg" pools are not new, for Gulf and Glenn McCarthy opened a southside pool in Vicksburg at 7,570 ft. in November 1947 (A on map); this discovery was (and still is) the deepest test on the dome, at 12,940 ft., bottomed in salt. A recently abandoned deep test (B on map) was drilled to 11,602 ft. by Gulf. Later, in January 1948, another pool in Vicksburg was found by Gulf 1 Smith (C on map).

Have launched a hot play . . . But stagnation set in at that point and it was not until September 1954 that the current "hot play" was born. From the imaginative minds of Scurlock Oil Co. geologists came the discovery at D; this launched the most widespread development so far, the eastside 6,900-8,100-ft. pool, which already exceeds the previously known domal area. Then, in December 1955, Magnolia Petroleum Co. found a Vicksburg pool on the Shamrock-Hilton property (E on map) and started a north and west-side campaign that still has a long way to go.

Today the original domal crest is almost completely ringed about with the new deep Vicksburg pools. More than 150 wells have been finished in the "new" pay and new ones are coming in at the rate of 20 per month. These new wells will reveal ever more numerous slices in the pie, and to imaginative oil finders, the recipe for similar finds in the future lies in Formula 209.

GUIBERSON DRILL PIPE PROTECTOR RUBBERS



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Guiberson drill pipe protector rubbers show their quality when we first put them on your pipe. And in the hole, they *stay put.* They can work in high temperatures or in oil base drilling muds— take a powerful amount of wear and abuse. *They keep their grip.*

You get extra casing protection and extra performance from Guiberson protector rubbers because they're made from a special wear-resisting rubber compound, designed for universal application in all kinds of drilling. And you get it because Guiberson just plain *knows how* to mold and compound rubber products that can take the tough jobs in today's wells — and lick them.

That extra rubber know-how comes from Guiberson's long years of experience in manufacturing rubber products specifically for the oil industry. It comes from a rubber plant and laboratory staffed and equipped to do the specialized job right. When you want drill pipe protectors that won't walk and do maintain their original OD for a long, useful life, look to Guiberson for the answer.

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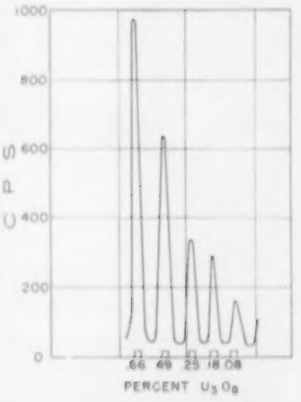
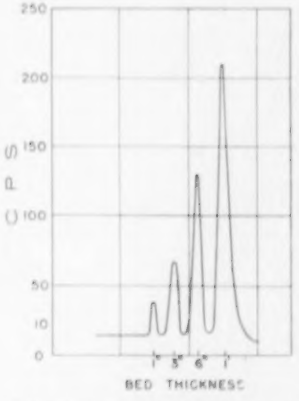
A TYPICAL URANIUM LOGGING UNIT working with a geophysical field crew. Fig. 3.



THE RESPONSE of a gamma-ray detector in an artificial test hole varies with the ore concentration when the bed thickness is constant. Fig. 1.



THE RESPONSE of a gamma-ray detector in an artificial test hole varies with the bed thickness when the ore concentration is constant. Fig. 2.

Uranium Hunters Adopt Oil-Exploration Techniques

by R. A. Broding and Ben F. Rummerfield

THE personnel, concepts, instrumentation, techniques, and philosophies developed in petroleum exploration are readily adaptable to and extremely useful in exploring for radioactive minerals. Petroleum and uranium exploration can be efficiently combined, in many sedimentary areas. The desirability of such a marriage is self-evident.

The course of world events, as well as economic and political developments, demand that we obtain the optimum from our mineral exploration talents and abilities—regardless of what the mineral may be. The need exists to pool our experience, talents, and energies to attain this objective.

Exploration for uranium ores is a science, just as is petroleum exploration. The merely random examination of outcrops or terrain does not begin to reveal the ore potentialities of an area. A systematic exploration program which is comprehensively directed and interpreted is essential to the discovery and development of radioactive ore bodies.

Authors are with Century Geophysical Corp., Tulsa. Article presented at the Nuclear Engineering and Science Congress, Cleveland, and previously appeared in Mines Magazine, published by Colorado School of Mines Alumni Association.

Recent uranium discoveries suggest that exploration for uranium should not be confined to a specific geological or geographical province. U_3O_8, like petroleum and gold, is where you find it.

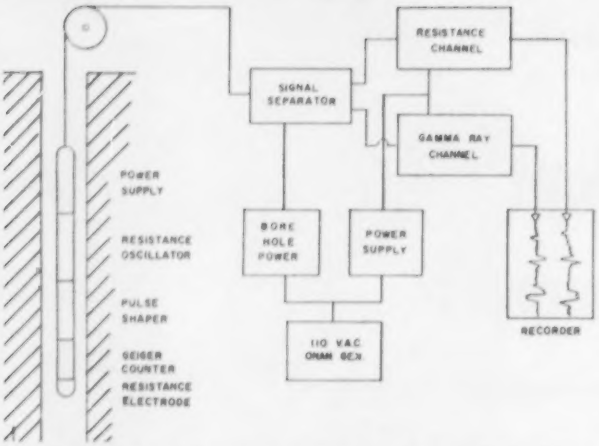
A large area of common interest exists between exploration for uranium and for petroleum. The factors studied in either exploration effort can generally augment and facilitate the other. The radioactivity of sediments has long been recognized as a reliable parameter for geological studies.

The broad tectonic skeleton of both igneous and sedimentary areas serves as a framework for the source, conduits, and reservoirs of mineral deposition. Studies concerning mineralization, lithology, and stratigraphy necessitate the use of such aids as structural contour, regional trend, isolith and isopachous maps, and others. Regional dip, synclinal and anticlinal trends, possible channeling of old erosional surfaces, pinchouts, faulting, and other common geological phenomena must be considered. The common approach, vocabulary, thinking, and philosophy allow an easy transition of thought from petroleum exploration to radioactive mineral exploration.

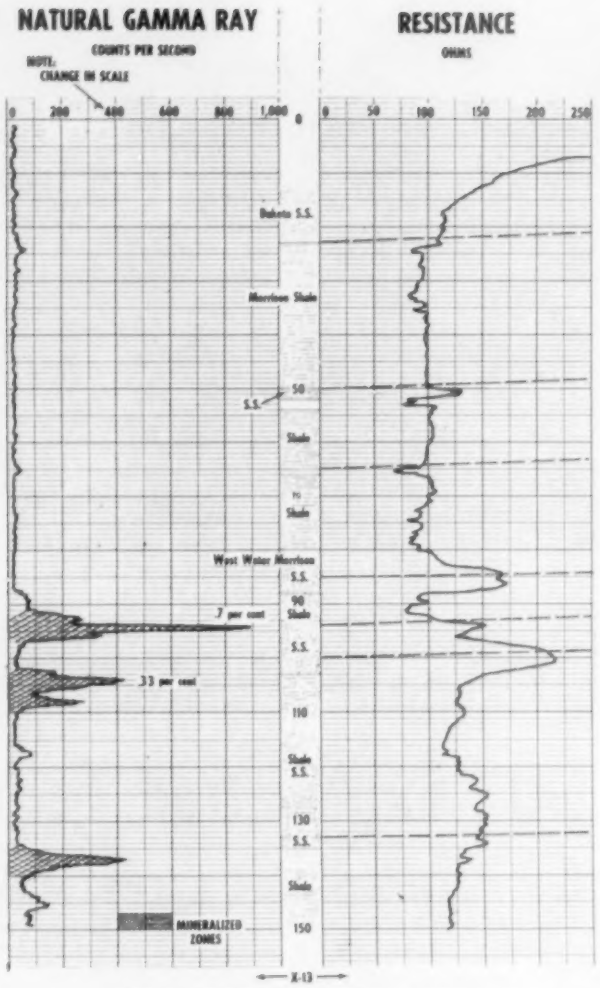
Combining petroleum and uranium exploration . . . In many sedimentary areas such as the Colorado Plateau, it is feasible to combine petroleum and uranium exploration; very little additional expense of effort is incurred. The equipping of field geological parties or geophysical crews with adequate gamma-ray detecting instrumentation is easily accomplished. The field parties also can gather radioactivity information which can be coordinated with the geological data normally obtained.

The incorporation of aerial scintillometer surveys with airborne magnetometer surveys and the combination of other reconnissance investigations could prove ambidextrous in their application to both petroleum and radioactive mineral studies. Exploration

EQUIPMENT such as this is well suited for logging geophysical shot holes. Fig. 4.



BLOCK DIAGRAM of one type of logging unit for uranium prospecting. The combined curves enable the interpreter to evaluate both radioactivity and lithology (see Fig. 6). Fig. 5.



A CROSS-SECTION from the Colorado Plateau. Notice

for radioactive minerals has been discussed in various publications prepared by the Atomic Energy Commission and the U. S. Geological Survey. Many other excellent references by both private industry and governmental agencies are available.

Application of gamma ray and resistance logs . . . One application of petroleum - exploration instrumentation and techniques to uranium exploration is the use of gamma ray and resistance logging. It is estimated that approximately 3 million feet of boreholes will be drilled this year in exploration for uranium on the Colorado Plateau alone.

To evaluate this footage properly, it is necessary to obtain either continuous cores or radioactivity and resistance logs of the holes. As a matter of economics, it is not only a great deal faster to log the holes than to obtain cores, but it is also from five to ten times cheaper.

It is well known that a mantle of a relatively few inches will completely mask the effect of any underlying radioactive ore body. Therefore, the drilling of test holes is essential to evaluate an area. This first reaction is usually to think in terms of utilizing a Geiger counter or scintillometer to investigate cuttings from the test holes.

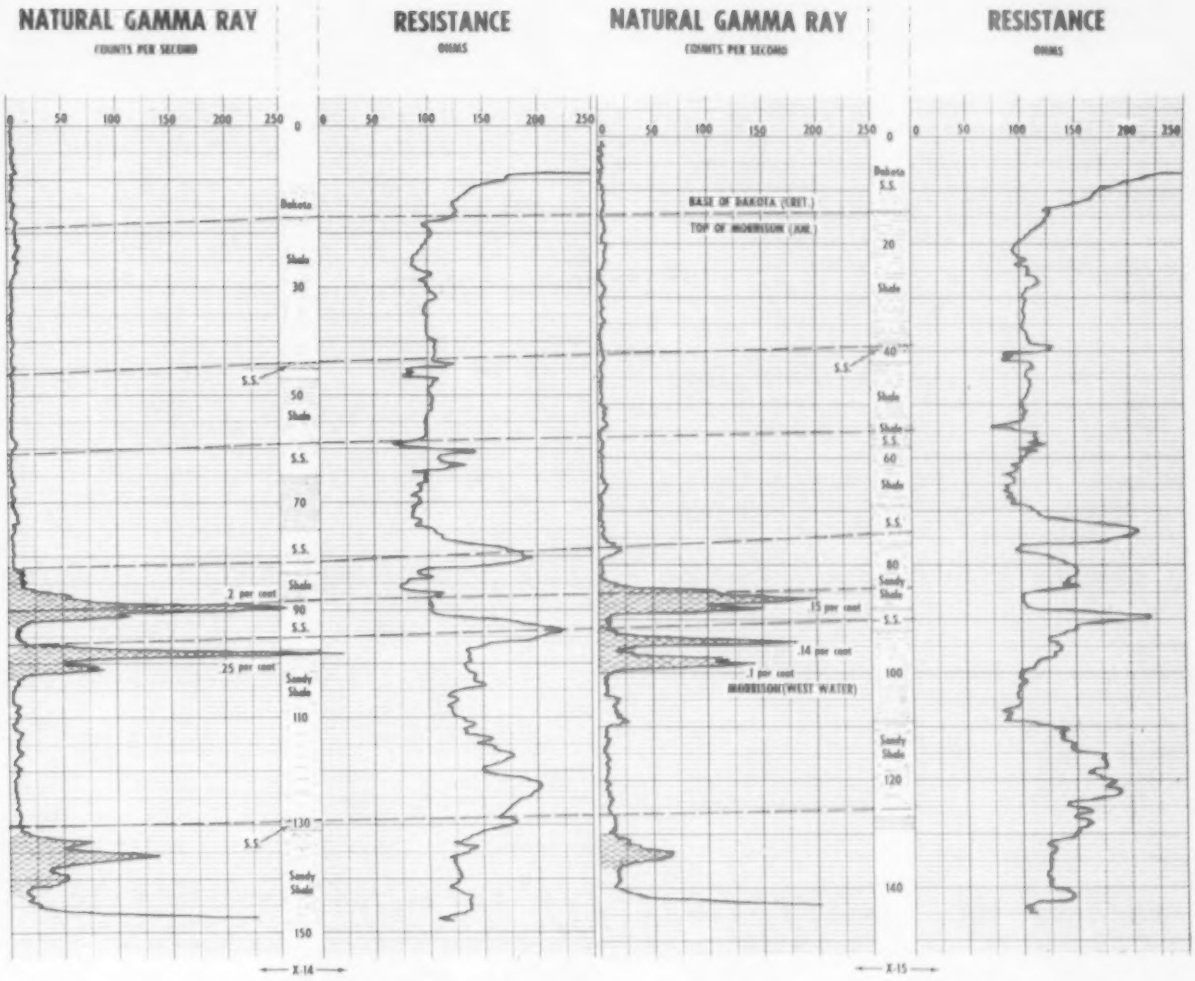
Since such an investigation merely indicates the possibility that an ore body has been penetrated. the next reaction is to suspend the probe in the borehole to determine the magnitude of the activity in situ and the depth of the source.

If the problem is merely to indicate the presence of an ore body directly as a quantitative proposition, it would be a relatively simple matter to solve it by these techniques alone. The mode of deposition and concentration of uranium ores is complex, and depends upon a relatively unknown interrelation of stratigraphy, lithology, and chemical conditions.

Therefore, a qualitative as well as a quantitative type of exploration is mandatory. High calibre instrumentation is required that will yield a continuous log of the natural gamma-ray activity as well as a log that will identify lithology. To meet this requirement, a combination gamma ray-electrical resistance log is considered to be the best tool known.

Since uranium itself is not a gamma-ray emitter, it is important to note that the measurement of gamma rays cannot be used to detect uranium directly. Fortunately, the uranium series has five daughter elements that are gamma-ray emitters. A gamma-ray detector, therefore, measures the relative proportion of these gamma - emitting elements in the ore, providing that it is in equilibrium.

If the ore is in equilibrium, a calibration curve can be drawn which relates counts per second, or microroentgens per hour, to per cent U_3O_8 equivalent. Thus, a radiometric assay can



that the mineralized zone is easily recognized and that the resistivity log permits reliable correlations from log to log. Fig. 6.

be obtained in the borehole. Such surveys are correct only to within 15 to 20 per cent, but they are still helpful in providing a relative measurement of the ore concentration.

Calibration curves must be established for each logging rate, time constant, bed thickness, borehole diameter, and the area involved. Chemical analyses should be run on cores obtained from hot holes to evaluate fully the properties of the ore body. By comparison with the radiometric assay, chemical analyses will help establish calibration curves and determine whether a condition of equilibrium exists.

Conditions of inequilibrium, resulting in excessive radioactive solution concentrations, can be detected by lack of reproducibility of anomalies in successive logs from the same hole. Experimental work is being carried on at present in an effort to solve this problem.

Fig. 1 illustrates the response of a gamma-ray detector in an artificial test hole to various concentrations of ores with constant bed thickness. A comparison log, shown in Fig. 2, illustrates the response in an artificial test hole to ore beds of various thicknesses but with identical concentrations. Calibration runs of this type are the basis for correction curves which are described later.

Experience has taught that uranium-bearing minerals have an affinity for sedimentary deposits where there is a change of facies. That is, lenticular fluvial sandstones that grade into siltstone and mudstone are more favorable for uranium mineralization than are massive clean sandstones. Carbonized-fossil plant matter is usually associated more with uranium mineralization than are massive clean sandstones.

Carbonized-fossil plant matter is usually associated with uranium minerals in sedimentary rocks; also, uranium minerals seem to prefer a buff or light-colored matrix in contrast to red-colored host rocks. Carbonates are usually low and phosphates are high in uranium content.

Because of these factors, an accurate lithological log is an essential accessory to the gamma-ray log. In some areas, the gamma-ray log gives a fair indication of lithology. However, since this log measures only the amount of natural radioactivity in the rocks and does not necessarily indicate the type of rocks, the gamma-ray log is considered to be a poor lithologic log.

Resistance logging is recognized as the best means of obtaining lithologic information, since most rock types are characterized by definite ranges of electrical resistivity. The resistance log, recorded simultaneously with the gamma-ray log, results in the ideal combination for uranium exploration.

Through the use of a combination resistance and gamma-ray log, it is possible to construct regional preference maps outlining areas in which the uranium prospector is most likely

to succeed. Regional dip, the pinching out, lensing of sediments, and other factors can be detected and used as sign posts in the effort to determine direction of mineralization.

Geological marker horizons often can be picked from the resistance logs and sometimes from the gamma-ray logs. Shallow structural maps can be prepared which are valuable not only in petroleum exploration but also in uranium exploration.

In some instances, formation identifications can be made. For example, in many areas of the Colorado Plateau the salt wash or lower Morrison section can sometimes be identified by characteristic resistivity markers. This is significant, as the salt wash has proved to be the most important source to date of uranium ores in this area.

In many areas it is feasible to combine petroleum and uranium exploration, with very little additional expense or effort. The logging of seismic shot holes, stratigraphic tests, and core holes is readily accomplished under this scheme. Admittedly, the control obtained in ordinary seismic surveys can be considered reconnaissance only, when applied to uranium exploration, but valuable information can still be obtained.

Such information can be acquired with little additional cost, as the major expenditure, that of drilling the hole, already has been made.

Fig. 3 illustrates a typical field operation in which the logging unit is mounted on a power wagon and is shown logging a hole while the seismic recording truck is laying out cables preparatory to shooting the next spread. Fig. 4 shows standard logging truck in operation with boom assembly.

Logging instruments are available that allow for the simultaneous logging of natural gamma-ray activity and electrical resistance of the rock surrounding a bore hole. One instrument called the gamma-R logger, is illustrated schematically in Fig. 5.

A profile from the Colorado Plateau area is shown in Fig. 6. These logs illustrate the type of correlations that can be expected between lithology and the resistance log, as well as the correlation and assay of a mineralized zone that is made possible by the gamma-ray log.

Acknowledgments

The authors wish to acknowledge the contributions of C. W. Zimmerman in instrumental development; Archie Nicol for assistance in field-operation techniques; and the Atomic Energy Commission, Climax Uranium Co., and Rocky Mountain Uranium Corp. for their permission to use information obtained in actual field practice.

EXPLORATION HIGHLIGHTS

HUGOTON EMBAYMENT

TEXAS PANHANDLE

Missouri Gas Sand Discovery Reported

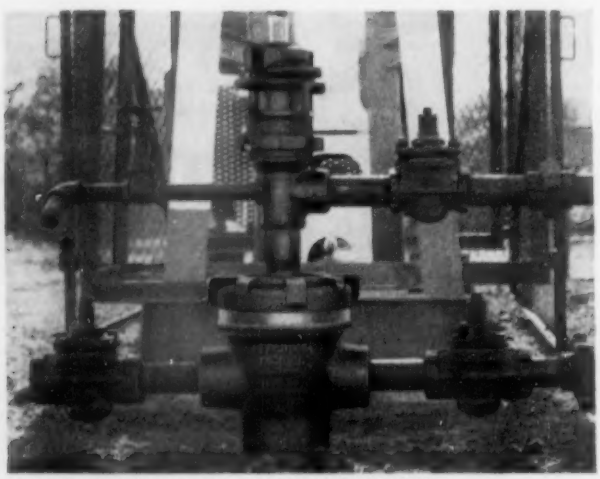
Shell Oil Co. has opened a new gas field about 1 mile east of Honolulu's new discovery in Ochiltree County at 1 Audry Fern-Stump. The Missouri producer flowed 3,300 M.c.f. of gas per day on absolute open flow potential from perforations at 6,510-36 ft.

This new field is located in Section 48, Block 4-T, T&NO Survey.

Oil Strike Reported East of Waka Townsite

Shell Oil Co. has an apparent oil strike at its 1 Schaefer, 1 mile east of Waka and 1 mile west of the R. H. Fulton 1 Barber Morrow discovery.

What the WELL-DRESSED, MEDIUM-PRESSURE Wells are wearing



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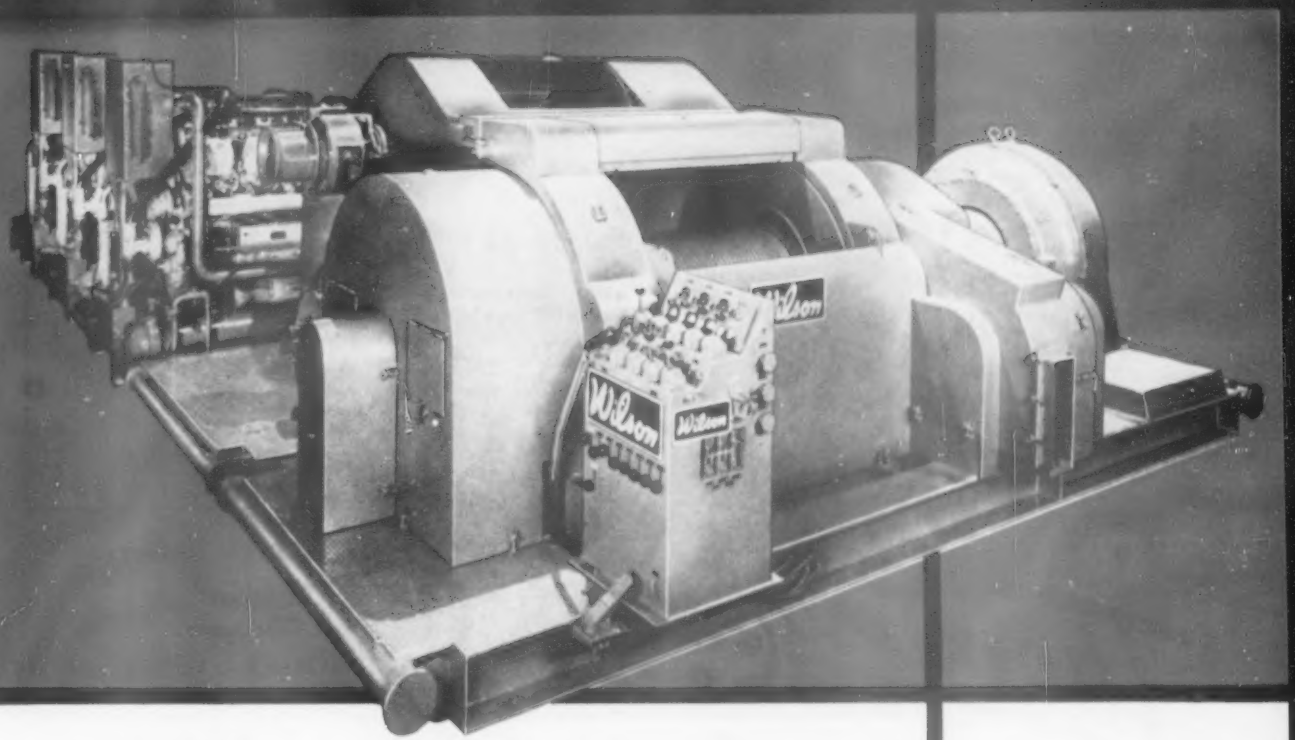

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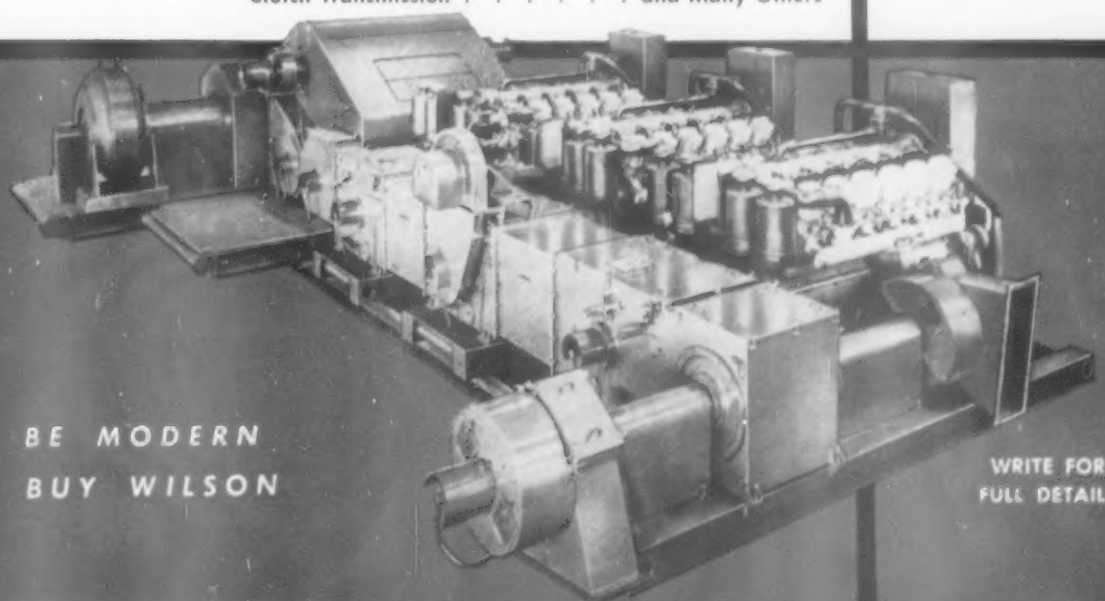

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The Shell well recovered 1,700 ft. of free oil on drill-stem test at 7,650-60 ft. The Fulton well was completed flowing 621 bbl. of oil per day from the Morrow.

New Ochiltree Discovery Flows Gas-Distillate

Honolulu Oil Corp. opened a new gas-distillate pool 26 miles southwest of Farnsworth-upper Morrow field in southwestern Ochiltree County.

The 1 Ollie B. Ray flowed 4,500 M.c.f. of gas per day plus 5 bbl. of distillate per million from perforation at 7,846-54 ft. Location is 9 miles east of Spearman in Section 49, Block 4-T, T&NO Survey.

SOUTHWEST KANSAS

New Gas Pool Opened In Southern Kiowa

South Kiowa County has a new Mississippian gas reservoir as a result of Gramehart-Miller's successful wildcat, the 1 Kane Ranch in NE NE 12-30s-18w, 5½ miles southeast of Nichols pool and 10 miles southeast of Greensburg, Kans.

The well flowed an estimated 5,000 M.c.f. of gas per day on a drill-stem test at 4,906-50 ft.

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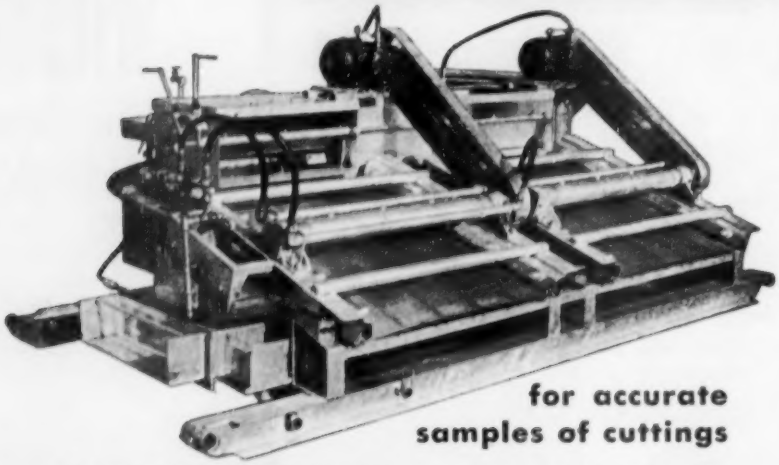

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Rocky Mountain	206
Great Lakes	206
South Texas	208
South Louisiana	209
Southeastern States	210
Successful Wildcats	210

NORTHWEST OKLAHOMA

Viola Tested at Harper Discovery

More Viola lime has been tested at Woods Petroleum Co.'s significant discovery in eastern Harper County, the 1 Seevers, C NW NW 6-27n-20w. Perforations at 6,960-89 ft. flowed 7,300 M.c.f. of gas per day with ½ bbl. of condensate per hour flowing into tanks; an estimated 1½ bbl. per hour flowed over the vent in separator.

This wildcat flowed 733 M.c.f. of wet gas per day through original perforations at 6,996-7,010 ft. A test at 6,969-7,023 ft. flowed 7,500 M.c.f. per day.

OKLAHOMA PANHANDLE

New Hoover Area Draws Offset Wells

Two important gas discoveries in Beaver County are due offset tests. British-American Oil Producing Co. will drill a diagonal northwest offset at 1 Allen in SE NW SE 25-4n-27eCM, offsetting Cabot Carbon Corp.'s recent 1 Barby-E Hoover gas discovery in SE NW SE 31-4n-28eCM. That well flowed 32,415 M.c.f. of gas per day from perforations in the Hoover sand at 4,318-34 ft.

B.A. will also drill the 1 Barby estate in C NW SE 26-4n-26eCM, just west of Cabot's Lovell sand discovery at 1 Barby-D, C SE NW 25-4n-26eCM. That well flowed 4,162 M.c.f. per day. Cabot will drill the 1 Barby-F in C NE SW 30-4n-27eCM, east offset to the discovery well.

APPALACHIAN

OHIO

W. D. Collins et al, drilling south of the old Bremen field in Rush Creek Township, Fairfield County, found a

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2-bbl. showing in Clinton at 2,489-2,516 ft. on the Susan Myers lease, Section 27. In a 24-hour test 1 week after fracturing the producer gaged 85 bbl.

● East Ohio Gas Co. extended its Franklin pool nearly 1 mile west into Chippewa Township, Wayne County. On 1 Jos. Magyar, Section 36, gas gaged 300,000 cu. ft. natural and 2,950,000 cu. ft. after fracturing. Clinton was found at 3,877-97 ft.

● Production in southeast Perry Township, Licking County, was extended a location north by E. H. Everett Co. on 1 E. Evans, Lot 16. Clinton was logged at 2,947-95 ft. and made 245 bbl. in a 24-hour test after fracturing.

● In the southwest part of Walhonding, Newcastle Township, Coshocton County, R. B. Weed et al 1 R. Rodehaver gaged 441 bbl. in the 24-hour test after fracturing Clinton at 2,957-3,010 ft.

PENNSYLVANIA

Mt. Pleasant Township, Westmoreland County, southwest Pennsylvania, Peoples Natural Gas Co. 4100 Henry E. Leighty, reached a total depth of 8,679 ft., with no gas and shut down. No further drilling will be done.

● Armstrong Township, Indiana County, Columbian Carbon Co. 1833 Susie Yosurack, is drilling at 6,460 ft.

WEST VIRGINIA

In Plymouth district, Mercer County, West Virginia, United Fuel Gas Co. 2-8422 F. H. Cheatwood shallow wildcat, elevation 2,475 ft., resulted in 47,000 cu. ft. gas after shot, Maxon sand 1,490-1,635 ft., gas 1,490-1,635 ft., gas 1,490 and 1,562 ft., TD 1,876 ft.

● No. 9993 E. Fike, shut down in this formation at 5,187 ft., to fracture in this formation. Gas at 5,018-21 ft., tests 440,000 cu. ft.

● Licking district, Tucker County, Hope Natural Gas Co. 9854 William Blair, wildcat being deepened has reached a depth of 4,898 ft. Gas was encountered in the Oriskany sand at 4,872-75 ft., testing 1,981,000 cu. ft.

WEST TEXAS-NEW MEXICO

WEST TEXAS

North Upton Test Gets Clearfork Production

J. E. Jones Drilling Co. 1-19 Meineis "19," an old well worked over in Section 19, Block 39, Townshjp 5 South, T&P Survey, 30 miles south of Midland, was completed flowing 246 bbl. of oil per day through open 2-in. tubing in the Clearfork sand.

This well flowed its oil from perforations at 7,136-46 ft. It was originally drilled by Seaboard Oil Co., taken to 13,200 ft., and abandoned. Location is about 4½ miles southwest of new Clearfork production in the south part of Midland County at J. E. Jones 1-39 Wilson Block "39" Clearfork field.

Irion County Has New Oil Discovery

What is believed to be a Clear Fork sand discovery flowed oil on drill-stem test at 2,865-77 ft., according to reports from Irion County. Ohio Oil Co.'s 1 Ada Morehead A/C "1," 5 miles southwest of Mertzon, is in Section 79, Block 1, H&TC Survey.

Devonian Gas Flows at Winkler Prospect

Superior Oil Co. 1-A J. B. Walton, Winkler County wildcat, 4 miles northeast of Kermit in Section 21, Block B-3, Public School Lands Survey, flowed

gas and sprayed distillate on the first drill-stem test in the top of the Devonian.

Operator is now testing at 8,310-40 ft. The test at 8,246-8,310 ft. flowed 2,556 M.c.f. of gas per day. Top of the Devonian is 8,210 ft.

Devonian Prospect in Pecos Coring Ahead

A new Pecos County Devonian discovery was coring ahead below 5,222 ft. last week. Charles Wacker's 1 Breene, 12 miles southwest of Imperial in Section 56, Block 10, H&GN Survey, started coring at 5,214 ft., the bottom of its third drill-stem test in the Devonian. All tests showed oil. Top of the Devonian is at 5,175 ft. The entire section was cored with good shows all the way down.

WEST CENTRAL TEXAS

New Swastika Pool Opened in Jones

Jones County has a new Swastika oil field opening up at Hack Drilling Co. et al, 2 Mason estate, 5 miles southeast of Noodle. The southwestern Jones County strike pumped 25 bbl. of oil per day from perforations at 2,986-96 ft.

Another Swastika well, the 1 Mason estate, 933 ft. of the No. 2 well, made 27 bbl. per day. The third well in the area, the northwest offset of the No. 1 well, 3 Mason estate, pumped 45 bbl. of oil per day from open hole at 2,987-98 ft.

ARK-LA-TEX

NORTH LOUISIANA

Baskinton Looks Good

Franklin Parish's new Baskinton field in northeastern Louisiana seems destined to be a major oil reservoir for North Louisiana. Leasing is brisk. Murphy and Sun Oil Co. took on 3,000 more acres since August 14 . . . they bought a northeast-southwest trend from the discovery well, 7 miles southwest of the discovery well. Tracts are in Sections 1, 10, 11, 12, 14, 15, 16, and 22 of 15n-7e; sections 6 and 18 of 15n-8e, and sections 30 and 32 of 16n-8e.

Murphy-Sun Oil Co.'s D-4 J. E. Holt well in 28-16n-8e, 1,300 ft. south of the discovery well, cored the thickest pay section yet found in the field last week. Core results: 3,878-3,921½ . . . 1 ft. sand with slight odor, 17 ft. shale, 3 ft. sand, 21½ ft. of medium grained sand, porous and permeable, good odor and taste. A core from 3,926-46 ft. got 4 ft. shale. Log was run at 3,946 ft. with drilling continuing to 3,975 ft. This thick Paluxy sand will be tested.

Good flowing oil wells have been completed at both the discovery well and east offset confirmation.

South Baskinton . . . A. J. Hodges Industries, Inc., completed 1 J. R. Scott, et al, in C SW NW 16-15n-8e, opening South Baskinton field, Franklin Parish. The well flowed 182 bbl. of oil per day on ¼-in. tubing choke from Paluxy sand at 4,595-99 ft. The confirmation well is below 4,000 ft.

ARKANSAS

The Arkansas Oil and Gas Commission has issued a drilling permit to the Reynolds Mining Corp. to drill a test well for gas and oil in the Harmony neighborhood, several miles southeast of Greenwood in Sebastian County.

The well will be known as the 1 Ida A. Holland and will be located in the Ida A. Holland neighborhood. Plans have been made for drilling to

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a depth of 5,000 ft. The well will be the third test in the Greenwood area.

MID-CONTINENT

KANSAS

Cambridge Arch Well Is New Discovery

Another oil discovery in northwest Kansas' portion of the Cambridge arch is nearing completion. Joe Rothmeir and Sauvage & Dunn Drilling Co. have set casing at their 1 Kilzer in SE SE NE 2-1s-27w, northern Decatur County, just south of the state line of Nebraska.

Recovery on a Lansing-Pennsylvanian drill-stem test at 3,281-3,304 ft. was 150 ft. of gas and 80 ft. of heavily gas-cut mud. Another test at 3,461-76 ft. got 2,050 ft. of clean oil. Location of this newest of Cambridge arch successes for 1956 is 1 mile northeast of the recent discovery at Warner pool, made last spring by Cities Service Oil Co.

Twentieth Field Conference Kansas Geological Society

The Kansas Geological Society invites you to attend its Twentieth Field Conference, a 2-day excursion in northwestern Arkansas on Friday, October 19 and Saturday, October 20, 1956. This conference is under the leadership of Dr. Norman F. Williams, state geologist of Arkansas, with the cooperation of the Arkansas Geological and Conservation Commission.

The subject of the conference is Lower Pennsylvanian stratigraphy of Arkansas, with emphasis on the relation of these rocks to oil and gas-bearing horizons in southwestern Kansas. During the course of the trip the following stratigraphic units will be observed.

Hartshorne sandstone and Atoka formation, Lower Middle Pennsylvanian; Bloyd shale and Hale sandstone, Morrow group, Lower Pennsylvanian; and Pitkin limestone and Fayetteville formation, Chester.

Conference Program

Thursday, October 18 . . . Afternoon and evening: Registration in lobby of Mountain Inn Hotel, Fayetteville, Ark.

Friday, October 19 . . . Morning and afternoon: Stratigraphy of the Morrowan series and underlying Chester rocks in the Ozark Highlands. Along the caravan route there are many excellent exposures, including the Morrow-type section. At one locality the entire Morrow sequence may be examined from the basal unconformity up to overlying Atokan rocks. The mileage for the day is approximately 170 miles.

Saturday, October 20 . . . Morning: Stratigraphy of the Atoka formation in the Arkansas River Valley and Ouachita Mountains.

Afternoon: Geology of Magnet Cove, a Cretaceous igneous intrustive having an extremely varied suite of rocks and minerals. A visit will be made to the barite mines of the National Lead Co. and Magnet Cove Barium Corp. There will also be an excursion to the bauxite mines near Benton, Ark.

Guide Book

The Guide Book will contain maps and a detailed road log of the caravan route. It will be illustrated with photographs, columnar sections, and regional correlation tables. In addition, it will contain several papers on various aspects of the geology of the area.

Each participant will receive a guide book at the time of registration. Additional books may be purchased for $5 each.

Registration

All hotel reservations and meals have been arranged by the committeee. The

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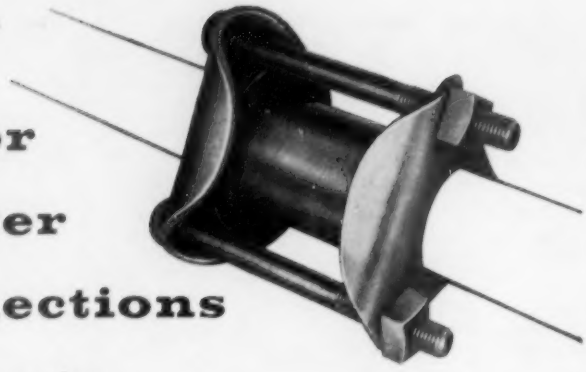

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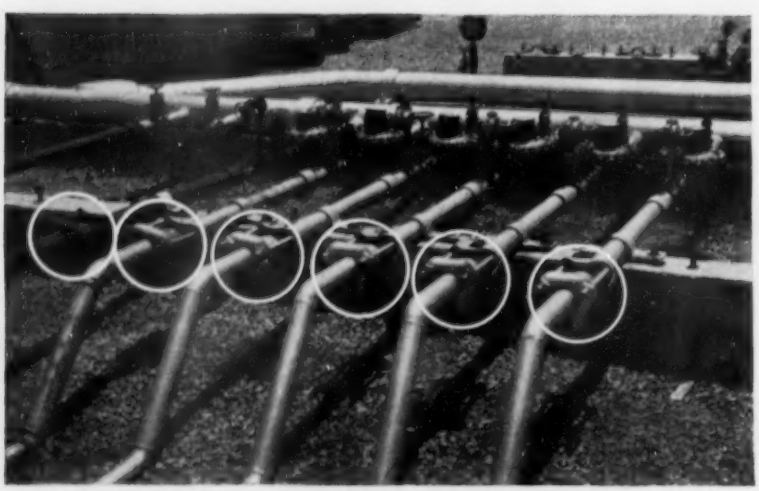

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registration fee for the Field Conference will be approximately $13.00. This will include the Guide Book, two breakfasts, two luncheons, and one dinner. Participants will be treated to a cocktail hour Friday evening and refreshment stops on the road through the courtesy of several oil field service companies.

Advance Registration

Advance registration should be made by writing to Field Trip Committee, John E. Hickok, chairman, Kansas Geological Society, 508 East Murdock, Wichita, Kans. It is urged that advance registration be made before October 15.

EASTERN INTERIOR

ILLINOIS

In Jackson County, A. J. and H. W. Lipka 1 Herman Eilers, NE SE NW 14-7s-4w, was finaled pumping 31 bbl. of oil per day from the Cypress sand at 866-69 ft. after fracturing. This important discovery, although the potential was rather small, should open a new drilling play in an area 20 miles from production. Location is 2 miles northwest of Ava.

A far-removed wildcat in southwestern Illinois may start a new play in an area 20 miles from existing production. Location is on the southwest rim of the Illinois basin in the Ava area of Jackson County.

Cooks Mills Is One Of Region's Biggest

Cooks Mills Consolidated field in the Arcola Douglas-Coles counties area is one of the biggest producers in the Tri-State region. Oil is now flowing into the Ashland Oil & Refining Co. lines from the Arcola and Quinn Chapel area. There are 172 wells in the Cooks Mills field area, making about 5,164 bbl. of oil per day, or about 150,000 per month.

Drilling is just about quiet in the

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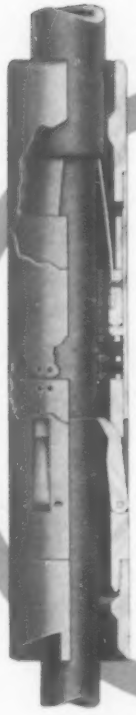

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SPRING-CUSHIONED cutting action assures faster, smoother cuts.

AUTOMATIC SPACING makes cuts below—not on—couplings or tool joints.

NO OVERSHOT NEEDED — cut-off section removed with Cutter. Cut and recover in one trip—with one tool.

SAME BODY with simple alterations cuts pipe equipped with any type joint.

Features of Baash-Ross Internal Cutters

SPRING CONTROLLED cutting action.

CENTRALIZED SUPPORT of Cutter prevents off-center strain on knives.

REPEATED CUTS can be made without removal of tool.

VARIOUS WEIGHTS of same size pipe can be cut without changing Cutter.

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Bourbon area. Only one well was in operation there last week. Eight rigs are drilling southwest of Arcola and seven in Cooks Mills.

Biggest Well This Year for State

The biggest well completed this year in the Tri-State region is Athene Development Co. 1 Carson Scrivner in the C N½ S½ 27-3s-5e, 2 miles northeast of Dahlgre in Hamilton County. The well was completed flowing 114 bbl. of oil per hour from the Salem lime at 4,109-25 ft. after acid treatment. This deep test is 1½ miles from other production.

PACIFIC COAST

CALIFORNIA

Texaco Gets Another Big Bridge Area Well

The Texas Co., as operator for itself and Union Oil Co., gave the Bridge area, South Mountain field in Ventura County, its seventh straight producer. Texaco 1 Texas-Union-Stine, a northwesterly extension 500 ft. from nearest production, was completed flowing 1,223 bbl. daily of 31.3°-gravity crude through a 22/64-in. choke from 7,170-7,941 ft. The field now extends more than 1 mile in an east-west direction. No dry holes have been drilled in the immediate area since its discovery earlier this year.

GP Extends Devils Den Discovery Area

General Petroleum Corp. successfully extended production on the northwest flank of the recent fault block discovery area at Devils Den field in Kern County. GP 32-3 Alferitz, located about 1,000 ft. from Bandini Petroleum Corp.'s discovery well, was brought in flowing 196 bbl. daily of 45°-gravity crude through a 16/64-in. choke from 3,640-70 ft. GP has another extension staked more than ½-mile northeast of 32-3 Alferitz.

San Mateo Test Slated

Neaves Petroleum Developments will try again in the mountainous LaHonda area of San Mateo County. Neaves has staked location for 3,500 ft. wildcat in SE NW 17-7s-4w. This is approximately 1 mile west of Neaves' wildcat abandoned July 2 at 4,271 ft.

Fillmore Test Fails

Standard Oil Co. of California has abandoned another deep test in the Fillmore field, Ventura County. After several redrills, Standard gave up on 5A Sespe Ranch at 14,475 ft. This test was located 1 mile west of the producing area.

New Orleans Program Announced by S.E.G.

An outstanding program of more than 40 papers covering the field of exploration methods, equipment, and research has been prepared under the guidance of O. G. Holekamp, program chairman, for presentation at the technical sessions of the twenty-sixth annual convention of the Society of Exploration Geophysicists meeting at the Roosevelt Hotel, New Orleans, October 29-November 1.

Holekamp, senior geophysicist with Shell Oil Co., New Orleans, said the theme of the technical sessions would include: Offshore exploration, instrumentation and research, foreign exploration, model studies, international geophysical year, economics and case histories.

In addition to the many natural attractions traditional to New Orleans setting, an extremely interesting field trip has been planned to observe airborne and water operations on the marshes of South Louisiana and in the Gulf of Mexico.

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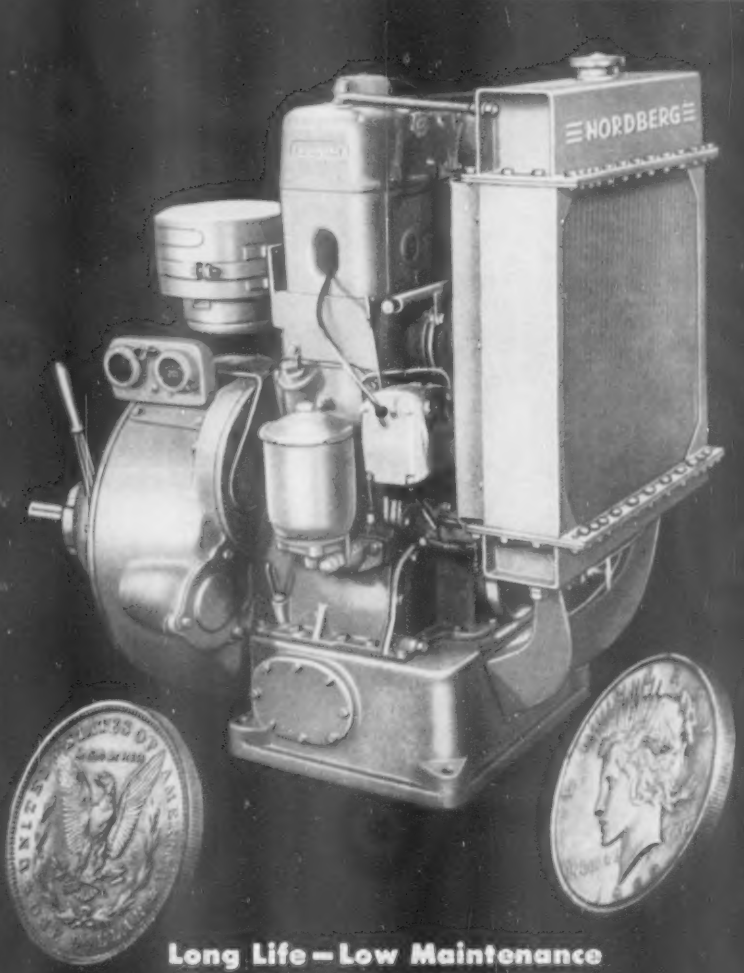

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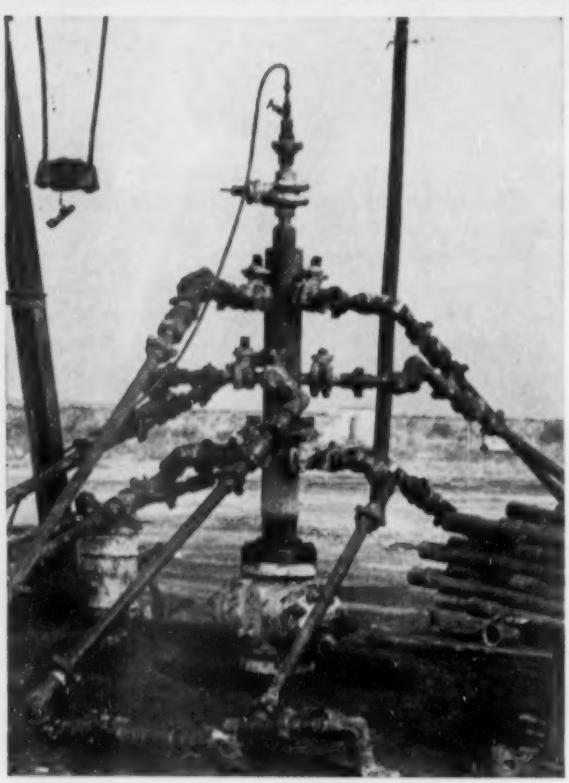

Ten connections were made to a special header on this well in the Spraberry for the record fracture job. These lines fan out to eight pumping units which were positioned about 40 yards from the well.

Biggest Frac Job

The biggest formation fracturing job in the history of the oil industry was accomplished recently by Dowell Incorporated when 250,000 gallons of fresh water and 200,000 pounds of sand were pumped into an oil well in the Spraberry area of West Texas.

This treatment was made with the new Dowell service called Riverfrac® — using water as the frac fluid rather than lease crude or refined oil. No thickening agent was used.

As an indication of the magnitude of the job, 18 mobile Dowell units were used. The pumping trucks alone generated more than 7000 engine horsepower. Hydraulic horsepower totaled 4500.

Two blenders to mix the sand and water, eight sand trucks, eight truck-mounted pumping units and several pieces of auxiliary equipment were required. Four of the units were the new Allison pumpers which employ aircraft power to give high injection rates. Two units were diesel pumpers and two were "super Continentals".

The blended water and sand was pumped into the Spraberry formation at an average injection rate of 52

in History . . . *another* DOWELL *first*

barrels, or 2184 gallons a minute. Surface working pressure was 3400 pounds per square inch.

The well which received this record-breaking treatment was completed at 7767 feet for a good flow of oil in 1953. Its production declined characteristically, and it was pumping 27 barrels a day when taken off production for this treatment.

The previous record fracture treatment was established by Dowell in the McCamey Pool when close to 100,000 gallons of water was injected.

For service, or for more information, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write Dowell Incorporated, Tulsa 1, Okla., Department I-11.

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Here is the "working area" for the record fracture job. In the foreground is one of two blender trucks which mixed the water and sand. In the center is a sand truck. Tanks which held the water are at left. Dowell's remote-controlled, Allison-powered pumpers are shown at right.

WESTERN CANADA

ALBERTA

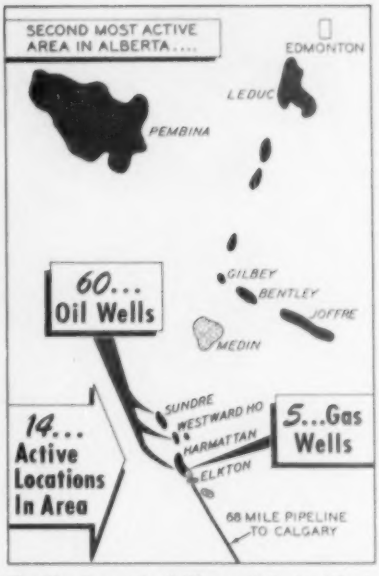
Sundre Region Moves To Second Place

Alberta's second busiest area is the 18-mile long Sundre-Westward Ho-Harmattan Mississippian reservoir in the southern part of the province. There are now 60 producing oil wells in the trend, 5 gas. Active locations in the region number 14 with 3 wildcat tests in operation.

Sundre boasts 27 oil wells, Westward Ho 12, and Harmattan 21. Sundre is a 1954 Mississippian discovery, and was considered the most significant discovery in Canada that year. Then came Westward Ho in 1955, another prize-winning strike. Late in 1955 Harmattan field was opened with prolific Mississippian production, and is now the biggest of the three in promise.

New pipeline coming . . . About the middle of September Cremona Pipe Lines, Ltd., expects to place its 68-mile crude line in operation from the region to Calgary. This line will move out 7,000 bbl. of crude oil per day from the three fields.

High level to continue . . . All indications point to continued activity in the three fields for the next several months.



The No. 2 area in drilling activity in Alberta is the Sundre-Westward Ho-Harmattan region in the southern part of the province.

Cardium Strike Details Released at Keystone

Cities Service has a significant Cardium discovery at its 16-21 Keystone test in Alberta, Canada, approximately 12 miles east of the Pembina field and 50 miles southwest of Edmonton. The wholly-owned discovery is located in the center LSD 16, 21-48-4w5.

On potential test, the well flowed 158 bbl. of 33.9°-gravity oil in 8 hours —for a 24-hour potential of 472 bbl. of oil. Production is from the Cardium sandstone through perforations between 4,332-40 and 4,296-4,325 ft., through a 24/64-in. choke.

Cardium Show Reported At Crossfield Wildcat

The Cardium sand formation, main producing horizon in the huge Pembina oil field of central-west Alberta, has yielded a very encouraging show of light gravity crude oil on drill-stem test at Shell Oil Co.'s A13-2 Crossfield exploratory venture in the southern sector of this province. The well is only 18 miles north of the Calgary city limits and 25 miles southeast of the closest production in the Mississippian oil producing area of Harmattan. Only one drill-stem test was conducted in the discovery horizon and was run over a 141-ft. interval with the top packer set 7-ft. below the Cardium sand contact.

Shell A13-2 Crossfield, lies on LSD 13, 2-28-2w5, and Cardium sand contact was measured at 6,670 ft. It lies 7 miles northeast of the Triad-Colorado

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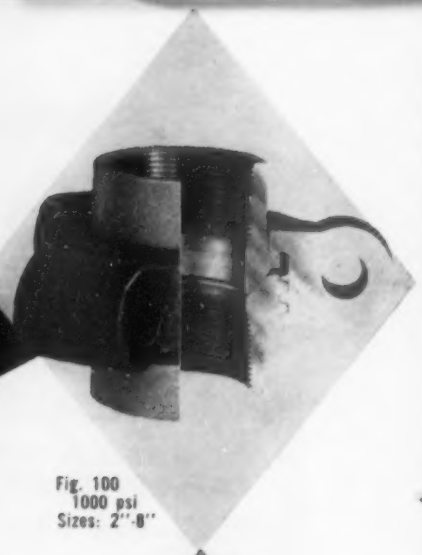

Fig. 100
1000 psi
Sizes: 2"-8"

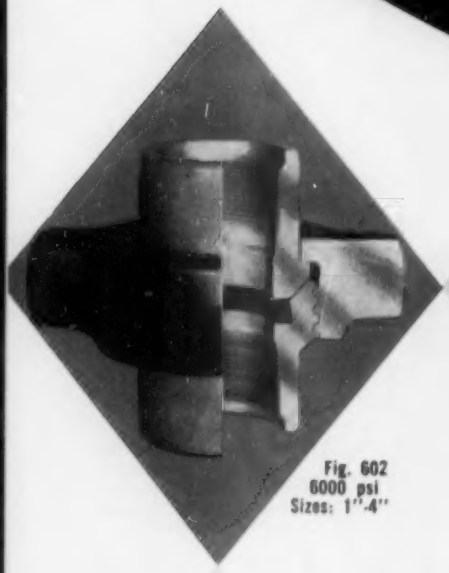

Fig. 602
6000 psi
Sizes: 1"-4"

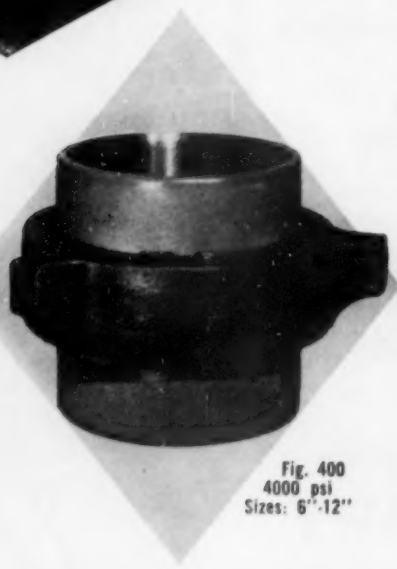

Fig. 400
4000 psi
Sizes: 6"-12"

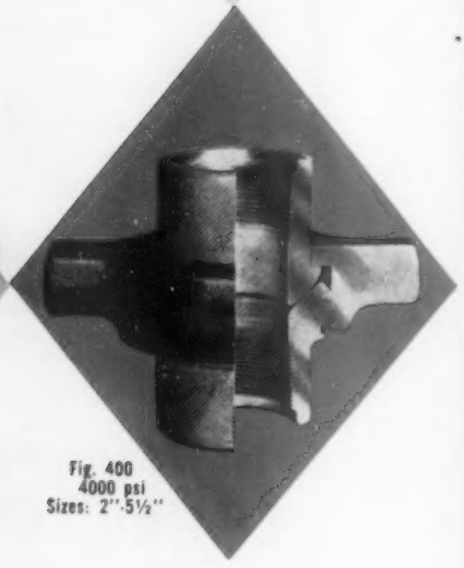

Fig. 400
4000 psi
Sizes: 2"-5½"

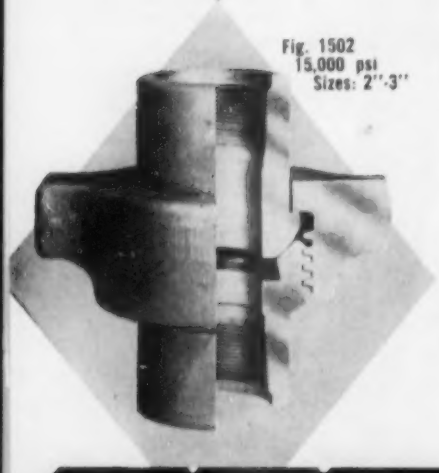

Fig. 1502
15,000 psi
Sizes: 2"-3"

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10-14 Bighill Creek, recently abandoned wildcat while a Shell abandonment lies 6 miles southeast of the new strike.

The well is scheduled to test the Rundle formation and crew was drilling below 7,500 ft. at last report.

Milk River Wildcat Recovers Clean Oil

Another southern Alberta wildcat focused the attention of the oil industry on that part of the country this week as Sinclair Canada Oil Co. released drill-stem test details on its current driller in the Claresholm area. The well is being drilled on acreage acquired from Security Freehold Petroleums, Ltd. The Calgary and Edmonton Corp. and Ross Securities, Ltd. A drill-stem test was run in a sand below the Milk River formation and 5,060 ft. of clean, 43.3°-gravity oil was recovered from the drill pipe.

This venture, Sinclair-C. & E. 1 Dahl, on LSD 7, 7-13-27w4, is situated 7¼ miles west-southwest of the Compagnie Francaise des Petroles 1 Stavely exploratory abandonment and is 65 miles south-southeast of Calgary. The Texaco-Baysel A-11-32 Pine Coulee Madison zone wet gas discovery lies 11½ miles north-northwest of the new strike.

Top of the pay zone was not reported due to correlation difficulties but drill-stem test was run of the interval 5,467-5,528 ft. Gas flowed at maximum 196,000 cu. ft. daily but by end of test had decreased to a rate too small to measure. Actual recovery was 5,450 ft. of fluid, comprised of the 5,060 ft. clean oil recovery and 390 ft. of oil and gas-cut mud.

Wet Gas Pay Opened At Wimborne Wildcat

Banff Oil, Ltd., has opened a total of 59 ft. of D3 zone wet gas pay at its current driller in the Wimborne area of southern Alberta, which lies 2½ miles north of the recent B.A.-Mobil 9 Klingstal Devonian oil and gas discovery well in the area.

Two drill-stem tests have been conducted at the hole and flows of gas up to 14,000,000 cu. ft. daily have been made along with substantial recoveries of condensate. Crew on the hole is currently cutting another core and further drill-stem test operations will be conducted.

The well, Banff 4-1 Wimborne, is on LSD 4, 1-34-26w4. Initial test in the zone was of the interval 7,340-55 ft. encountered gas at 8,000-10,000 M.c.f. daily with a recovery of 60 ft. of condensate. The most recent test, run from 7,365-7,407 ft. (59 ft. below D3 contact of 7,348 ft.), gas flow was measured at a maximum of 14,000,000 cu. ft. daily and still increasing at end of test. Pipe recovery consisted of 160 ft. of condensate and 20 ft. of mud.

SASKATCHEWAN

New Mississippian Strike in Southeast

Husky Oil & Refining, Ltd., operator of an exploration and development project in southeast Saskatchewan with Consolidated Mic Mac Oils, Ltd., and Commercial Minerals, Ltd., reported oil success at their 1 Huntoon well in both the Mission Canyon and Charles sectors of the Mississippian. This interesting step-out success lies just over 1 mile north of the main producing sector of the Midale oil field and is 2 miles southeast of North Midale pool.

This new well, Husky-Mic Mac-Canadian Superior 1 Huntoon, on LSD 7, 33-6-10w2, is on acreage farmed out to the group by Canadian Superior Oil of California, Ltd. Charles zone was topped at 4,425 ft. and Mission Canyon at 4,506 ft.

Initial test in the Charles gave up 440 ft. of clean oil and 360 ft. of oil and gas-cut mud while the second test in that zone gave up 110 ft. of slightly

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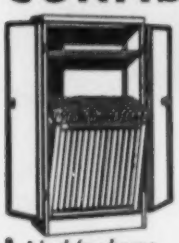

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gas-cut oil flecked mud. Drill-stem test in the Mission Canyon of an 8-ft. interval showed a pipe recovery of 2,350 ft. of gassy oil and 250 ft. of mud-cut oil.

ROCKY MOUNTAIN

ARIZONA

El Paso Scores at Four Corners

El Paso Natural Gas Co. scored a major gas field discovery in the Four Corners area of northeastern Arizona. El Paso 1 Bita Peak gaged 19,000 M.c.f. of gas daily with a spray distillate on a 30-minute test of the interval 5,080-5,102 ft. The 5,648 ft. wildcat is located in SW NW 19-41n-31e, 3½ miles southwest of Four Corners gas field production.

WYOMING

Deep Test at East Salt Creek Flows Tensleep Oil

A deep test, the first to Tensleep in 10-well East Salt Creek field, Natrona County, flowed oil at the estimated rate of 216 bbl. hourly on drill-stem test at 7,551-81 ft. The deep discovery is Sinclair Oil & Gas Co.'s 8 Government in SE NW SW 10-40n-78w.

East Salt Creek field was opened in 1951 with production in the discovery well from the second Wall Creek sand and from the Lakota. Location of the field is 3 miles east of the north end of Salt Creek field, and 5 miles south of Meadow Creek field.

Mud Flat Gas Strike Completed in Dakota

A new Dakota gas discovery was completed in Sweetwater County, Green River basin, by Mountain Fuel Supply Co. The discovery well is 1 Union Pacific, NW SE SE 23-20n-104w, 2 miles north of North Baxter basin.

The well gaged 7,000 M.c.f. of gas per day from Dakota from perforations at 3,633-38, 3,623-30, 3,563-91, 3,509-22, and 3,448-54 ft.

COLORADO

Gas Flows at Garfield Wildcat

Garfield County has a new gas producing area. The discovery well is Standard Uranium Co. 1 Young, SE NW 6-8s-102w, 1¼ miles southeast of Garmesa field, an old timer opened in 1925.

The well flowed gas at the rate of 6,684 M.c.f. per day on drill-stem test at 2,962-3,097 ft. Four sands were tested, either in the Dakota or Morrison.

NORTHWEST NEW MEXICO

Bisti Completions Reported by Sunray

Completion gages on five field wells in prolific Bisti field, San Juan County, have been released by Sunray Mid-Continent Oil Co. The 17 New Mexico-Federal "C" in C NE NE 7-25n-12w, made 240 bbl. per day on ½-in. choke. The 15 New Mexico-Federal "C," C NE NW 8-25n-12w, flowed 209 bbl. per day on 24/64-in. choke. The 16 New Mexico-Federal "C" flowed 375 bbl. per day on 24/64-in. choke, while the 3 New Mexico-Federal "B" in C NE SE 17-25n-12w, flowed 40 bbl. per day. The 4 New Mexico-Federal "B" well flowed 128 bbl. of oil daily on 28/64-in. choke.

GREAT LAKES

MICHIGAN

Dow Chemical Co. is conducting an interesting exploration and test program of Antrim shale gas in Chester Township, Otsego County. Currently,

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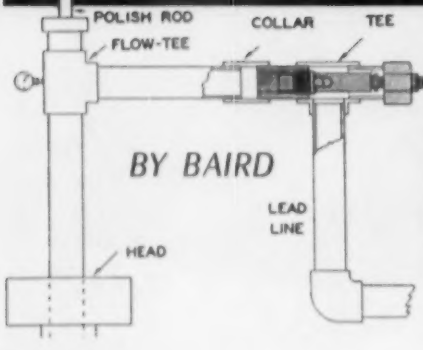

Keeps pressure on tubing strings.

For wells that head up and flow, back pressure on the tubing tends to keep the tubing full which prevents stuffing box trouble and increases pump efficiency. By maintaining a back pressure on the tubing, this regulator keeps gas from breaking out of the solution and thus helps to prevent paraffin formation.

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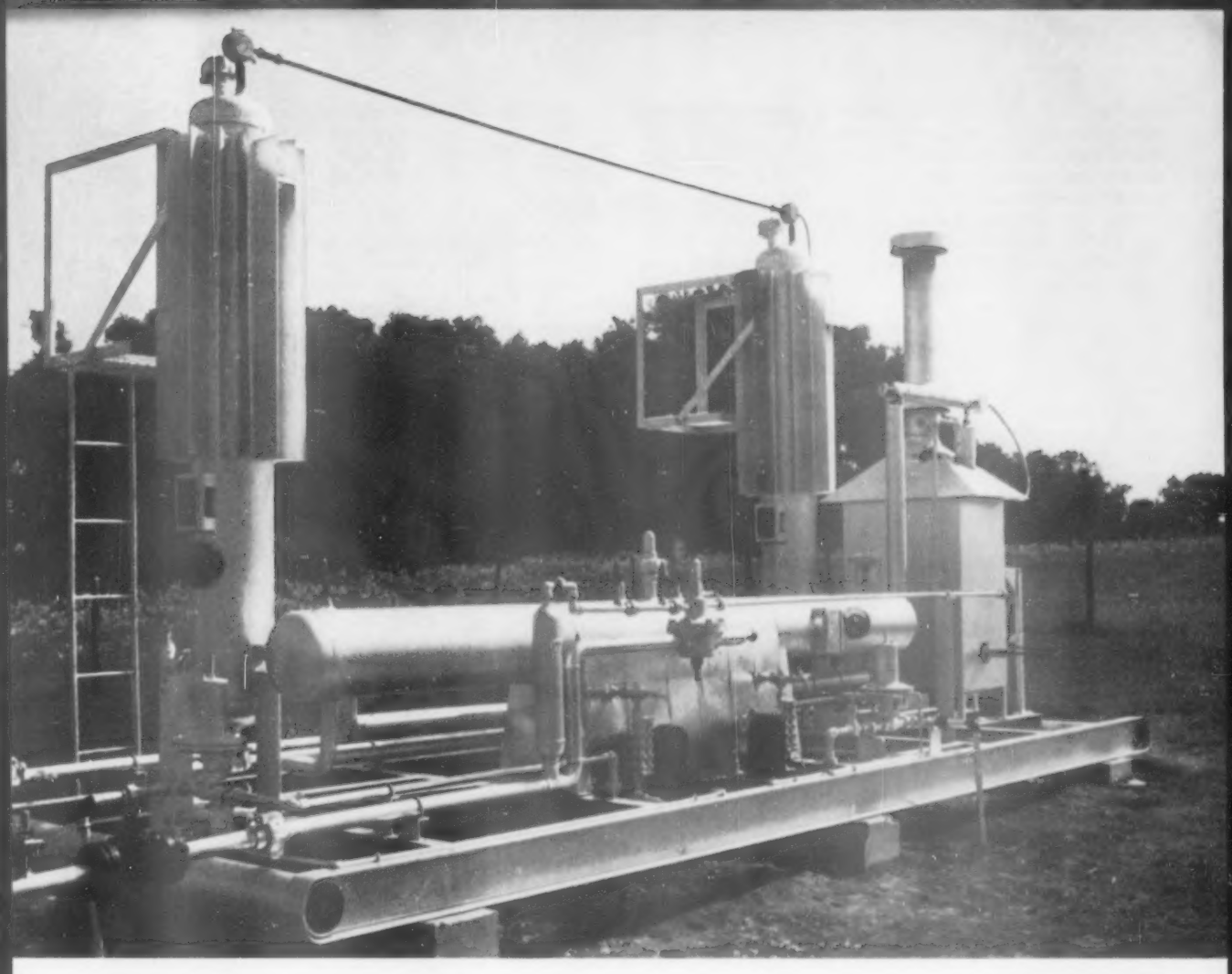

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delivers greater dehydration efficiency -- requires ⅓ less desiccant -- uses 80% less fuel gas

Since the DAU was designed to take full advantage of the dynamics of the adsorption process, each particle of desiccant develops the maximum possible efficiency. This enables the DAU to dehydrate a high pressure gas stream with only a few hundred pounds of desiccant compared to several thousand pounds required by conventional dehydrators.

Moreover, regeneration of the desiccant packs requires only about 20% of the fuel gas normally required by ordinary dehydrators. The savings on desiccant and fuel gas alone amount to hundreds of dollars—more than enough to pay out the low first cost of the PARKERSBURG DAU WELDRIER in an unusually short time.

It will be worth your while to talk over the many advantages of the new DAU WELDRIER with your Parkersburg Representative.

Parkersburg
RIG AND REEL COMPANY
DIVISION OF PARKERSBURG : AETNA CORPORATION

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5630

three test wells are in various stages of completion in this area. One is being tested after a sand fracturing treatment in this gas objective, while two others are being cored and completed.

Dow HE-3 State-Chester, E½ NE NE 15-29n-2w, was sand fractured with 120,000 lb. of sand and 620,000 gal. of water to pay that showed between 1,448-50 ft. Hole was drilled to 1,523 ft., total depth, and was cleaned out to 1,470 ft. following this fracturing operation. Water and sand were injected in pay zone at the rate of 15 bbl. per minute at a maximum pressure of 1,000 psi. Gas was in evidence natural, without being gaged. Well was reported to be showing an increase in gas following frac treatment, but this was not gaged up to the time of this report. Approximately 180,000 gal. of water were yet to be recovered at last report. Hole was being cleaned of water by swabbing.

Dow WN-1 State-Chester, SE NW SE 23-29n-2w, another Antrim shale test in the area, was being drilled below 1,330 ft. this week after 7-in. casing was set with rotary tools at 1,100 ft. The third test the Dow 1 Fee, SE SW SE 7-29n-2w, was being cored below 1,370 ft. after 7-in. casing was set at 1,107 ft.

SOUTH TEXAS

SOUTHWEST TEXAS

Salt Flat Field Extended

Caldwell County's old fault-line Salt Flat field is being extended 1½ miles northwest by a small Austin-chalk oil producer being completed by E. F. Hill, of Houston. The extension well, 1 Luling Airport, is 3 miles north of Luling townsite. It is being put on the pump after flowing by heads at the rate of 2 bbl. of 26°-gravity oil per hour. Pay is perforated at 2,410-26 ft. The operator plans five more wells on the airport lease.

TEXAS GULF COAST

Chambers Discovery Well Makes Record Gas Flow

Open-flow potential of the new discovery well completed by Dan J. Harrison, Jr., and associates on the north shore of the East Bay arm of Galveston Bay, in southern Chambers County, is estimated at 325,000,000 cu. ft. of gas per day.

The flow is the largest credited to any well completed on the Gulf Coast in several years. Liquid (56.8°-gravity condensate) recovery on flow tests was at the rate of 32.9 bbl. per 1,000,000 cu. ft. of gas. Shut-in pressure is 3,087 psi.

The well, 1 E. A. Wilborn, et al., is completed from casing-perforated interval at 9,319-27 ft., in Frio sand. It was drilled to 9,900 ft.

Its location is 15 miles southeast of Anahuac. It is 6 miles southwest of Oyster Bayou field, and about 5 miles east of East Mayes field, nearest production.

Victoria Test Indicates New Oil Producing Area

Testing is under way at Monsanto Chemical Co.'s indicated discovery well 5 miles northeast of McFaddin townsite, in southern Victoria County. Latest tests are of perforated interval at 5,360-81 ft. During a 3-hour gage, flow was at the rate of 37.8 bbl. of oil, 6.7 bbl. of water, and 590,000 cu. ft. of gas per day.

The well, 1 McCan, previously tested a lower zone, perforated at 5,401-04 ft., from which it flowed a short time, making 20 per cent oil and 80 per cent water.

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Larkin Geyser Float Shoe Fig. 322
Larkin Regular Float Shoe Fig. 302
Larkin Mate and Female Float Collar Fig. 401 M & F
Larkin Flapper Type Float Collar Fig. 404 M & F
Larkin Flapper Type Float Shoe Fig. 304
Larkin Regular Concrete Guide Shoe Fig. 202

Hole was drilled to 8,410 ft. and has oil-string to 5,530 ft.

Second City Dump Well Confirms Pierce Extension

Trice Production Co. has completed its second well on its Houston city dump lease off the east flank of the old Pierce Junction dome, at the southwest edge of Houston.

This well, which confirms the east extension made by the operator's first dump-lease well, completed last month, flowed at the rate of 141 bbl. of 35.8°-gravity oil per day through 15/64-in. choke. It is perforated at 8,179-84 ft. in the field's Vicksburg pay.

Nearby, Beck Oil Co. is completing its 4 Bailey Trustee, which flowed at the rate of 165.1 bbl. of 39.4°-gravity oil per day during tests through 5/32-in. choke. Pay is perforated at 8,165-75 ft.

SOUTHWEST TEXAS

Olmos Play Spreads in Dimmit-Maverick Area

While Sutton Petroleum, Ltd., is confirming its new Olmos-sand oil discovery in eastern Maverick County, Michel Halbouty and Pronto Drilling Co. have uncovered what appears to be another productive area from the same pay section about 12 miles southeast in northwestern Dimmit County.

The Halbouty-Pronto indicated discovery is in their 1 Robert Shook, a wildcat in I&GN Survey (Abstract 898), about 8 miles southwest of Carrizo Springs. It recovered 750 ft. of clean oil in a 30-minute drill-stem test at 2,919-26 ft. The test was made through ¼-in. chokes and recorded bottom-hole pressure of 340-555 psi., flowing, and 1,275 psi., shut-in.

A previous 30-minute test of a shallower Olmos pay at 2,714-22 ft. recorded working pressure of 450 psi., and bottom-hole pressure of 600 psi., flowing, and 1,200 psi. shut-in. No recovery was reported.

Sutton is confirming its Maverick County discovery with its 4 Ewing Halsell, 2,239 ft. southeast of its discovery well (3 Halsell). The new well is being put on the pump with pay at 1,303-11 ft. The discovery well, completed 2 weeks ago, flowed 21.81 bbl. of 38°-gravity oil per day on potential test through ⅝-in. choke. Its pay is perforated at 1,287-97 ft. with bottom of hole at 2,002 ft.

It opened the county's third field. Location is about 22 miles southeast of Eagle Pass, and about 3 miles from the Dimmit County line. It is about 11 miles south of Continental Oil Co.'s one-well Sacatosa field, productive from the Eagleford. It is about 10 miles west of nearest production, in the general Carrizo Springs area of northwestern Dimmit County.

SOUTH LOUISIANA

Deeper Sands Produce in Lake Pelto Extension Area

Sun Oil Co.'s second well in the new extension area off the east flank of Lake Pelto dome, in Terrebonne Parish's coastal marsh region, opens two deeper pay zones, one below 16,000 ft.

The well, 2 State Lease 2620, in Terrebonne Bay, is completed dually with pays at 15,738-63 ft. and 16,074-84 ft. It was drilled to 16,360 ft., and has oil-string to 16,344 ft.

From the deeper interval, it produced at the rate of 307 bbl. of 36.7°-gravity oil per day through ⅛-in. choke with pressure of 5,600 psi. and gas-oil ratio of 3,475 cu. ft. per barrel.

Flow from the upper zone was at

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the rate of 309 bbl. of 34.5°-gravity oil per day with pressure of 4,300 psi. and gas-oil ratio of 1,139 cu. ft. per barrel.

Sun's east-side discovery well, completed last March, produces from sand at 15,526-36 ft.

SOUTHEASTERN STATES

MISSISSIPPI

Indicated Yazoo Discovery Set for Additional Tests

Pumping equipment is being moved in for further testing of the indicated Lower Cretaceous discovery well recently drilled by Texas Crude Oil Co. and Jett Drilling Co. in the Wolf Lake area, 7 miles northwest of Yazoo City, in northern Yazoo County *(The Oil and Gas Journal, August 20, 1956, page 294)*.

Work on the well, 1 Cary, was suspended several weeks ago when swabbing tests recovered only salt water with a scum of oil. The indicated basal Paluxy pay was perforated at 7,402-08 ft. Previously, in an open-hole drillstem test at 7,408-47 ft., the well had filled 1,080 ft. of 42°-gravity oil with 660 ft. of water and 120 ft. of mud. For this, tester was open only 15 minutes through ¼-in. and ⅜-in. chokes.

After the drill-stem test, hole was drilled to 7,646 ft., and casing cemented at 7,512 ft.

Additional testing will be done by Jett Drilling Co., contractor on the well, which has taken over direct operation from Texas Crude Oil Co.

Successful Wildcats

ALBERTA

White Rose-C. & E.-H.B. 11-11 Innisfail, LSD 11, 11-35-1w5. TD 8,742 ft. Basal Cretaceous oil well.

SASKATCHEWAN

Husky-Mic Mac-Canadian Superior 1 Halbrite, LSD 1, 8-7-11w2. TD 4,618 ft. Charles oil well.

Imperial 7-22 Alameda, LSD 7, 22-4-3w2. TD 4,440 ft. Mississippian oil well.

Shell 13-5 Dreher, LSD 13, 5-3-1w2. TD 4,939 ft. Mission Canyon oil well.

ARIZONA

Apache County: Franco Western Oil Co. 1 Navajo, SW NW 22-41n-28e. IP 7,450 M.c.f. of gas per day, ½-in. choke, Paradox discovery, new field. TD 5,900 ft.

OKLAHOMA

Beaver County: Stanolind Oil & Gas Co. 1 Barnett Unit, NW NW SE 30-5n-24eCM. IP 4,819 M.c.f. of gas per day, Morrow sand 6,441-48 ft. TD 6,604 ft. (Gas discovery.)

Garvin County: Pure Oil Co.-Superior Oil Co. 1 Rakestraw, 2 miles north of East Maysville, NW NE SE 2-4n-2w. IPF 335 BOPD, Viola lime 6,020-50 ft., 1-in. 32°. TD 7,450 ft. (Oil discovery).

COLORADO

LaPlata County: Longhollow Producing Corp. 1 Ted R. Hubbs, SW NW NW 13-33n-12w. IPP 20 BOPD, Dakota discovery, new field. TD 3,502 ft. Morrison.

KENTUCKY

McLean County: C. Wood, 1 Corum, SW NE SW 30-N-26. IPP 150 BOPD, Cypress sand, 1,949-62 ft. TD 1,962 ft. (Discovery well of North Proverty field).

NEBRASKA

Kimball County: Banner Oil Co. 1 Gross, C NW SE 3-14n-56w. IPP 150 BOPD, "J" sand discovery, new field. TD 6,535 ft. "J" sand.

WEST VIRGINIA

Mercer County, Plymouth district: United Fuel Gas Co. 2-8422 F. H. Cheatwood, elevation 2,475 ft., 47,000 cu. ft. gas, Maxon sand 1,490-1,635 ft., gas 1,490 ft., and 1,562 ft., TD 1,876 ft.

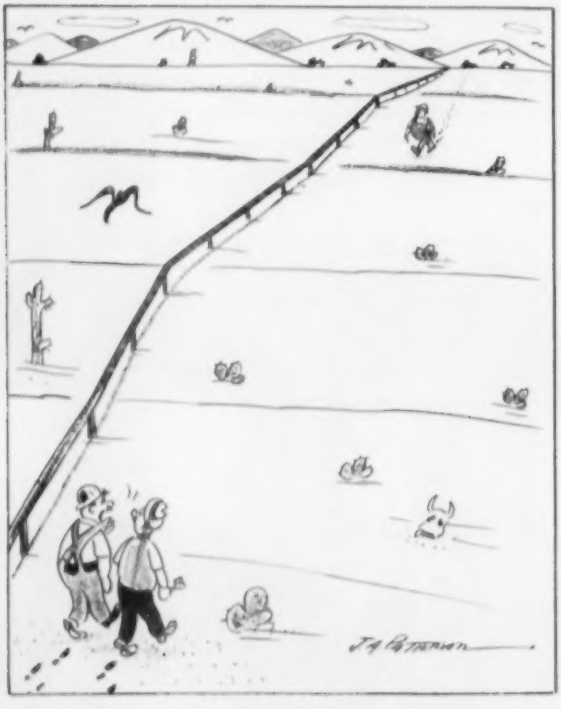
WYOMING

Crook County: Glenwood Oil Co. 1 Barton Brothers, SE NW SE 27-50n-65w. IPP 4 BOPD, Lakota discovery, new field. TD 225 ft. Morrison.

Owanah Oil & Development Co. 31-1 Federal, C SE SE 31-52n-67w. IPP 4 BOPD, Muddy discovery, new field. TD 3,982 ft. Lakota.

Natrona County: Stanolind Oil & Gas Co. 1 Unit, C SE NW 3-40n-77w. IPF 181 BOPD, 13/64-in. choke, Muddy discovery, new pay. TD 11,512 ft. Muddy.

Park County: Continental Oil Co. 27 Unit, SE NE SW 32-57n-99w. IPP 30 BOPD,



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Frontier discovery, new pay. TD 8,400 ft. Tensleep.

NORTHWEST NEW MEXICO

Sandoval County: Texas National Petroleum Co. 1 Maddox, C SW SW 34-23n-6w. IPP 17 BO 24 hours, Gallup sand discovery, new field. TD 5,513 ft. Gallup.

SOUTH LOUISIANA

Acadia Parish: Tidewater Associated Oil Co. 1 Rayne, 7-9s-2e. IP 111 BCPD and 1,280 M.c.f. daily, ⅛-in., 52.6°, perforations 15,290-15,308 ft. TD 15,456 ft. (New pay and extension in Rayne field.)

Iberia Parish: The Texas Co. 44 State-Fausse Point, Lease 293 in Township 11s-8e. IP 125 BOPD, X-28 choke, 30.6°, perforations 7,146-56 ft. TD 7,420 ft. (New pay in Fausse Point field.)

Jefferson Parish: California Co. 1 Marrero 3, 44-14s-24e. IP 80 BCPD and 6,030 M.c.f. daily, ⅞-in., perforations 9,344-64 ft. TD 9,801 ft. (New field.)

Lafourche Parish: California Co. 1 Hotard et al, 78-17s-10e. IP 50 BCPD and 3,340 M.c.f. daily, 7/32-in., 53.6°, perforations 10,390-10,414 ft. TD 13,504 ft. (New pay and extension in Lake Long field.)

Plaquemines Parish: Continental Oil Co. (operator for CATC group) 10 State Lease 979, Blk. 54, West Delta area, Gulf of Mexico. IP 3,060 M.c.f. daily, 9/32-in., dry gas, perforations 4,836-46 ft., and (dual completion) 2,945 M.c.f. daily, ¼-in., dry gas, perforations 4,585-88 ft., and 4,592-96 ft. TD 5,565 ft. (New pay in West Delta Block 53 field.)

Terrebonne Parish: Shell Oil Co. 1-A Riggs, 93-17s-16e. IP 195 BOPD and 4,260 M.c.f. daily, 13/64-in., 44°, perforations 12,526-40 ft. TD 14,500 ft. (New field—Humphreys.)

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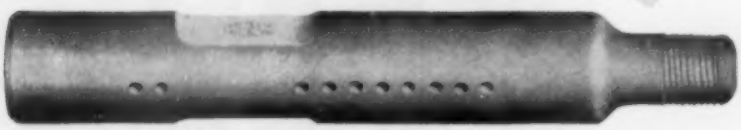

There are times when an ordinary rope socket will meet your needs. But there are too many times when you can't afford to risk trouble—when you require a rope socket that's precision made and utterly dependable under all conditions. This is the time you'll be glad to have a Spang Rope Socket on the business end of your string—

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EAST TEXAS

Wood County: E. B. Germany & Sons 1 D. B. Clonts, 5 miles SE of Pine Mills on Brooks & Burleson Sur. A-92. IPP 74 BOPD, 24°, sub-Clarksville 4,757-62 ft., GOR nil. TD 5,650 ft. (Oil discovery.)

NORTH TEXAS

Knox County: McMahon-Bullington Drilling Co. 1 A. J. V. Johnson, 2 miles northwest of Munday in Sec. 78, Blk. 2, D&W Sur. A-1726. IPF 142 BOPD, 18/64-in. choke, 35°, perfs. 1,949-59 ft. TD 2,057 ft. (Oil discovery).

Wise County: Southern Union Gas Co. 1 J. N. Elrod, 1½ miles southeast of Alvord in BBB&C Sur. Sec. 1, Lot 5, A-103. IP 11,250 M.c.f. of gas per day open flow plus 24.9 bbl. cond., perfs. 6,006-32 ft. (Gas discovery of Elrod field). TD 6,208 ft.

Young County: O. P. Leonard 4 S. A. Haggard, 12 miles west of Newcastle in TE&L Sur. 733, A-749. IPP 42 BOPD, 40°, perfs. 2,590-2,600 ft. TD 2,900 ft. (Oil discovery).

Alan T. Strong et al 1 W. O. Cenoebaugh, 2 miles east of Graham in SE¼ N. Lynch Sur. A-171. IPF 526 BOPD, 48/64-in. choke, open hole, 44.2°, top pay 2,251 ft. TD 2,252 ft. (Oil discovery).

SOUTHWEST TEXAS

Jim Hogg County: Coastal States Gas Producing Co. 1-E Yeager, Sur. 108, A-351. IP 27.76 BOPD, 5/32-in., 41°, perforations 3,596-3,600 ft. TD 3,609 ft. (Extends North Yeager field.)

Jim Wells County: Tidewater Associated Oil Co. 2 Freeborn Trustee, J. A. Mendes Sur. IP 13.29 BOPD, ⅛-in., 41.4°, perforations 5,501-05 ft. TD 5,650 ft. (New field—Freeborn.)

S. H. Howell 1 Brand-Buschelman Unit, I&GN Sur. 378, A-245. IP 8,400 M.c.f. daily, open-flow potential, GLR 128.4 M.c.f. per barrel, 66.4°, perforations 5,316-22 ft. TD 5,331 ft. (New pay in Wade City field.)

S. H. Howell 1 Brieger, E. E. Miller Subd., I&GN Sur., A-245. IP 4,200 M.c.f. daily, open-flow potential, GLR 80,340 cu. ft. per barrel, 51°, perforations 4,362-67 ft. (Frio). TD 4,420 ft. (New pay in Wade City field.)

Maverick County: Sutton Petrol, Ltd., 3 Ewing Halsell, H&GN Sur., A-1063. IP 21.81 BOPD, 38°, perforations 1,287-97 ft. (Navarro-Olmos). TD 2,002 ft. (New field.)

Starr County: Sun Oil Co. 10 Hall-State, C. B. Simpson Sur. 100 and 224. IP 120.45 BOPD, ⅛-in., 47.6°, perforations 4,383-87 ft. TD 5,001 ft. (New pay in North Rincon field.)

WEST CENTRAL TEXAS

Coleman County: N. M. Dillard 1 J. L. Crowder et al, 8 miles northeast of Coleman in John H. Wood Sur 483. IPF 46 BOPD, 16/64-in. choke, 44.5°, perfs. 1,902-08 ft. TD 1,928 ft. (Oil discovery).

Eastland County: Dan J. Harrison 1 A. J. Pippin, 3 miles east of Eastland in Sec. 4, Blk. 6, ETRR Sur. IP 50 BOPD, open hole, 39°, Duffer lime at 3,508 ft. GOR 1,500:1. TD 3,755 ft. (Oil discovery).

Jones County: Scaling & Hudspeth 6 Holland Holt et al, 3 miles southeast of Hawley in Subd. 37, Sec. 2, Blk. 20, T&P Sur. IPF 265 BOPD, 20/64-in. choke, open hole Cook sand at 2,025 ft. 39.4°. TD 2,030 ft. (Oil discovery).

Taylor County: George G. Steele 1 Martha Parker, 2½ miles SW of Tye on John McSherry Sur. 129. IPP 39 BOPD. Cook sand open hole at 2,435 ft. 41.7°. TD 2,441 ft. (Oil discovery.)

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Mr. George, Baroid's unique offshore drilling mud delivery vessel, has been put into operation servicing drilling rigs in the Gulf of Mexico off the coast of Louisiana. After a successful series of shake-down and trial runs, *Mr. George* made the first delivery to a well 12 miles off the Louisiana coast. Subsequent deliveries have been made that involved as much as a 120 mile round trip in the Gulf of Mexico.

The vessel, officially named GEORGE L. RATCLIFFE, is 196 feet long, 42 feet wide and 12 feet deep and has a payload capacity of more than 1500 tons. Products carried can be divided to give 1000 tons of bulk Baroid* plus all normally required bagged material. The vessel carries Coast Guard, Customs Registration and Star A-1 American Bureau of Shipping certification.

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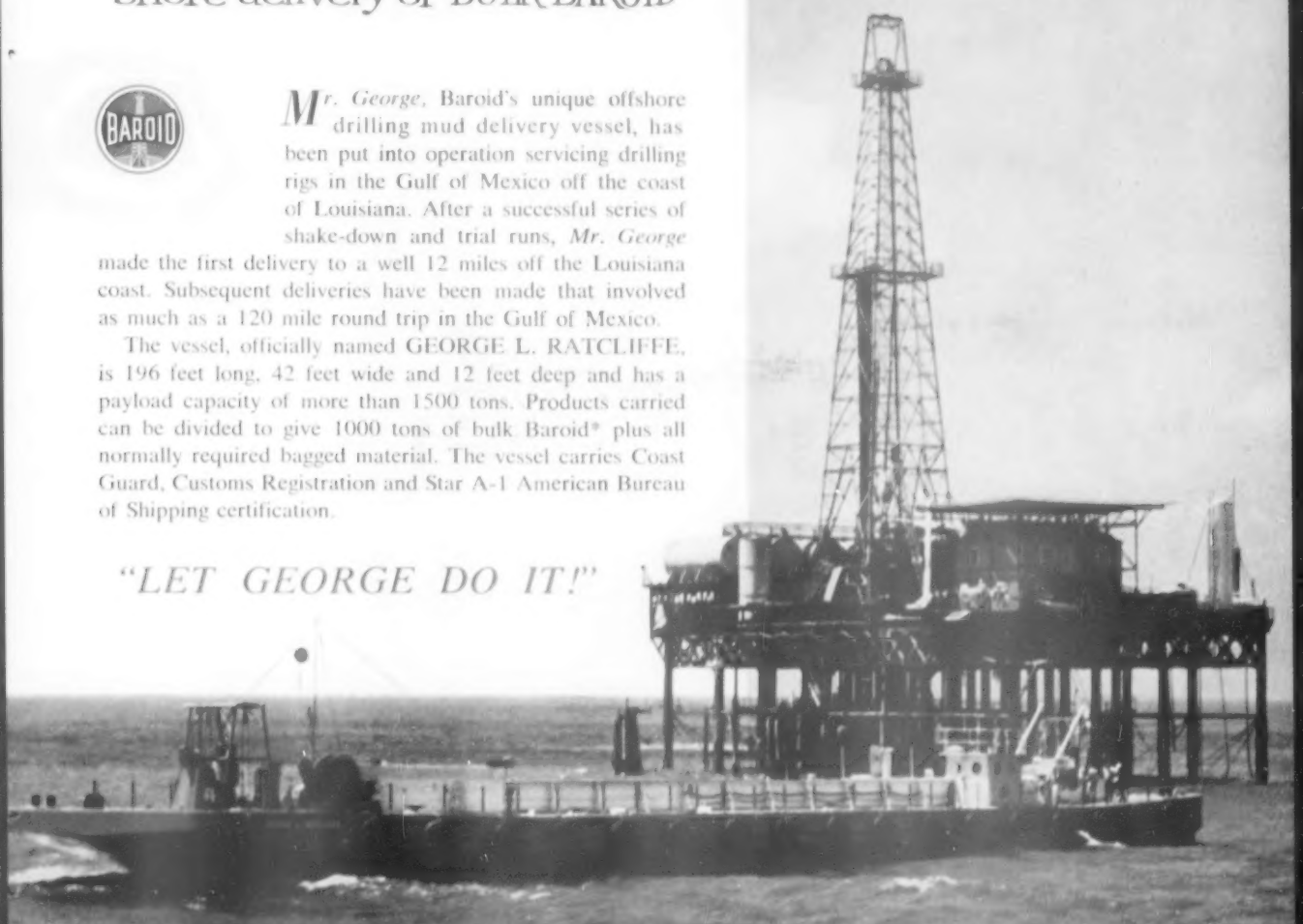

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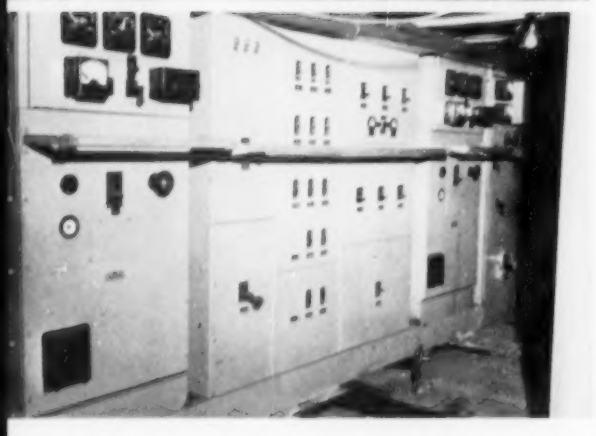
Mr. George is towed to the vicinity of the rig by a deep-sea tug equipped with radar, ship-to-ship and multi-channel marine radios. The *Mr. George* carries ship-to-ship and FM radios, thus communications can be maintained between the tug, rig, *Mr. George* and land bases at all times.

The tug is manned by experienced deep-sea operating personnel. The *Mr. George* is under the command of Captains D. A. Smith and W. F. Nesser; both are licensed ship masters with wide experience in deep-sea operations.

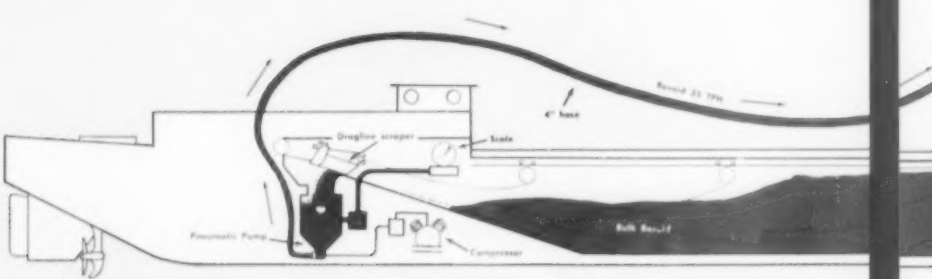
Upon approaching the rig the tug casts off its lines and the unique features of *Mr. George* are used to make the final approach, maintain position and make the mud delivery. Final approach involves the use of two systems. Using the first system, one or both of the two 6000-pound cruiser anchors located fore and aft of the vessel is dropped. Each anchor line is handled by a power winch capable of a 50,000-pound line pull. Using the second system, the multi-speed propulsion units located fore and aft are used to come into final position and then hold this position while deliveries are made. These propulsion units are driven by electric motors wound to give four speeds forward and three speeds reverse. Propellers are 54-inch diameter by 30-inch pitch and their rotational speed can be varied up to 352 rpm. The unique feature of the propulsion units is that they can be independently rotated through a full 360 degrees; therefore each propeller can push or pull in any direction. Normally one propulsion unit is set to counteract the current and the other to hold the anchor lines in the proper position.



The nerve center of "Mr. George" consists of the generator and distribution switchboards. The vessel's equipment is all electrically powered and the generators are equipped with automatic synchronizers. This photo made during "Mr. George's" construction period gives an idea of the size of switchboard.

This view looks forward into bulk mud hopper of "Mr. George." The hopper can carry a 1,000 ton payload of dry bulk Baroid. Bulk mud is gathered by a one cubic yard Sauerman scraper and pulled into position for filling the pneumatic pump hopper.

Schematic Flow Diagram showing the movement of the bulk Baroid mud from the hold of the delivery vessel through the pneumatic pump and delivery hose to rig storage tanks.



BAROID

"Mr. George's" powerful propulsion units are lowered when the vessel arrives at location. These units enable the vessel to make the final approach under its own power. Each propulsion unit, one fore and one aft, has four speeds forward, three speeds reverse and can be rotated through 360 degrees.

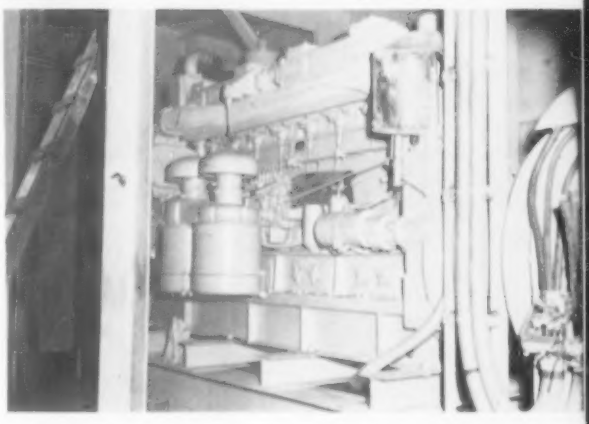
When bulk Baroid is delivered a heavy duty four-inch I.D. rubber hose is picked up by the rig crane and the end of the hose put into the rig bulk tanks. Actual delivery then begins and the dry bulk Baroid is pneumatically pumped to the rig storage. This system is much like the Navy method of refueling at sea. Delivery of bulk Baroid is in batches of 2500 pounds, and the automatic weighing equipment prints a weight ticket for each batch.

When palletized products are delivered, the rig crane drops its line with pallet hooks or sling attached and hoists the material aboard in the conventional manner.

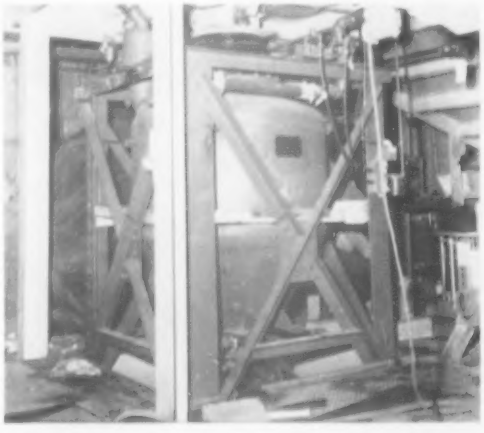
All equipment aboard *Mr. George* is operated electrically. Power is generated by diesel engine prime movers. The three engines and generators are capable of 685 KW output. The propulsion units will operate on any engine-generator combination.

Safety is one of the outstanding features of the *Mr. George*. The diesel-electric power system reduces fire and explosion hazard to a minimum. The anchoring and propulsion systems are designed to give maximum safety to the operator's personnel, rig, structure and tenders at all times. Safety to delivery and operator's equipment, reliability of delivery, accuracy of weighing, and time to get from one location to another have all been planned to give the best possible service in the safest manner.

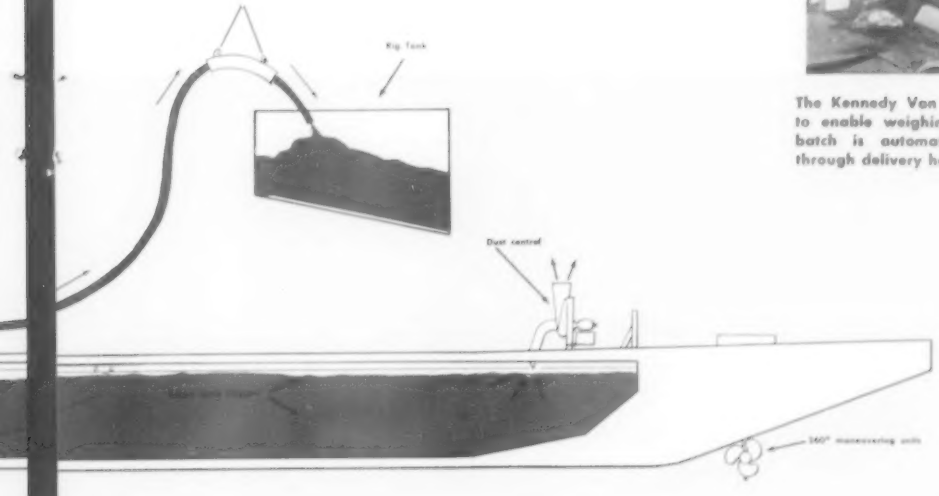
The large mud stock, which makes the vessel a floating warehouse, will reduce the hazard of offshore drilling and save operating time because the ready availability of this large mud stock will assist in controlling high-pressure wells.



All the operating equipment on "Mr. George" is electrically powered. Two Buda 250-KW diesel-electric generators furnish the electric power for operating the engines, anchor winches, dragline, pneumatic pump and all auxiliary machinery.



The Kennedy Van Saun pump is mounted in special flexures to enable weighing bulk mud in 2,500-pound batches. Each batch is automatically ticketed and pneumatically blown through delivery hose to bulk storage tanks on the offshore rig.



BAROID

1. Seaplane hangar and parking area
2. Crane barge unloading ore vessel
3. Ore piles
4. Carpenter, bulk can repair and machine shop
5. Mill building
6. Office building
7. Warehouse
8. Silo storage for "Mr. George"
9. "Mr. George" — delivery vessel

Baroid's new marine terminal

Baroid Division's new Marine Terminal, now under construction on the New Orleans Industrial Canal, will be home base for *Mr. George*. Besides docking and trans-shipping facilities, this terminal will have the largest mud warehousing facilities in the country. The warehouse will be backed up by a plant for manufacturing the product Baroid from both domestic and imported barite ores.

Facilities at Berwick, Louisiana, will also be utilized for keeping *Mr. George* supplied with mud.

Exhaustive testing and the recently completed series of actual deliveries have demonstrated that *Mr. George* is the safest, fastest, most convenient method of offshore mud delivery available.

BAROID

BAROID DIVISION • NATIONAL LEAD CO.
Main Office: P. O. Box 1675, Houston 1, Texas
New Orleans Area Office: 918 Richards Bldg.

BAROID

Ingenuity, education boost Tong . . .

. . . From Roughneck to President

JAMES A. TONG was born 35 years too soon.

A man with his academic credentials today would have his choice of a dozen jobs even before the ink dried on his many sheepskins. But the young man who shed his pilot's uniform after World War I to seek his fortune in the oil fields of Texas found a far different situation.

He was a Rhodes Scholar. He had graduated from the University of Arizona and held a Ph.D. from John Hopkins University. Geologists were a dime a dozen, however, and it took more than a college degree to land a job then.

The best Tong could hope for was to get on as a roughneck on a cable-tool rig. He approached a tool pusher who was having trouble with a fishing job at 80 ft. The tool pusher agreed to give him a try if he could recover the bit.

Tong accepted the challenge. After lowering a lighted candle down the 2-ft. surface pipe to determine that there was oxygen present, he descended on the cat line and chipped the bit free with his geological pick.

The ingenuity that got him his first job offers an insight into the man who last month was elected president of Socony Mobil Oil Co. de Venezuela. He succeeded John C. Case, a director of the parent company and its vice president in charge of production.

Venezuelan career . . . Tong went to Venezuela in 1923 as a geologist with Gulf Oil Corp.

He did a lot of work in rough country and soon earned a reputation as a rugged field geologist. The hazards of exploring the jungle are pointed up by an experience he had one day while eating lunch on the bank of a stream. He had unwittingly chosen a spot near a litter of mountain lions. The mother puma sprang on his back, and he still carries claw marks from the attack.

Tong moved to Socony de Venezuela in 1934. In 1939 he was made chief geologist. A year later his scope was widened to include other aspects of the business when he was transferred to the Socony affiliate in Colombia as assistant manager. He became manager of the Colombian company in 1943.

In 1948 Tong returned to Venezuela as general manager of Socony and became executive vice president a year later.

Personality . . . Tong is an optimist, and this outlook shows through everything he does. He talks in a deep, resonant voice and laughs easily.

He is open, vigorous, and friendly.

Tong speaks fluent Spanish. A good deal of his time nowadays is spent in liaison between his company and Venezuelan officials. But he is still a "working" man. If there is trouble on a well, he is willing to drive all night to get there.

While no longer assigned to the field, Tong has a big place in his heart for the outdoors. He is an avid hunter and fisherman and can shoot a pretty good game of golf.

Tong's family life is centered in Caracas. He is active in the American Church. His son, Jim, Jr., is in private business in Caracas. His wife is also an accomplished golfer and has won a number of trophies in local tournaments.

The Tongs maintain a ranch in Louisiana. They plan to settle there some day.

S. P. (Bud) Mandell, vice president and manager of Batex Oil Co., has resigned to organize El Tigre Oils, Ltd., in Dallas. The firm will operate in North Texas and South Central Oklahoma.

George S. Colley, vice president and director of Bechtel Corp., has been named executive vice president and director of Pacific Bechtel Corp., an affiliate. **M. E. Harper,** vice president of Bechtel International Corp., and **E. P. Kranzfelder,** operations manager of Bechtel's Korean electric generating plants, were also named vice presidents of Pacific Bechtel.

Personals

William N. Harman, engineer with Salt Lake Pipe Line Co., has been transferred from Rangely, Colo., to Salt Lake City.

John R. Miller, production engineer with Skelly Oil Co. at Sweetwater, Tex., has joined the Federal Power Commission in Washington as an engineer.

Theodore W. Link, petroleum engineer with Amerada Petroleum Corp., has been transferred from Tioga, N. D., to Watford City, N. D.

H. D. Henderson, coordinator of foreign operations for Sohio Petroleum Co., has resigned to join Trunkline Gas Co. in Houston as director of supply and production.

Elmer R. Erickson, executive vice president and secretary of Northwestern Refining Co., has been elected president. He succeeds his brother, **Arthur T. Erickson,** who will continue as a director of the company.

Harold C. Eaton, manager of the wax specialties department of Quaker State Refining Corp., has retired. He will be succeeded by **William K. Bayer, Jr.,** assistant manager of the department. Eaton has spent 45 years in the oil industry in Pennsylvania.

William L. Peyton, assistant to the manager of Continental Oil Co.'s geological section in Houston, has been promoted to division geologist in Midland, Tex. He replaces **H. H. Bybee,** who has transferred to the company's C.A.T.C. office at Houston.

R. H. Pearson, project engineer with Pure Oil Co. in Chicago, and **Pat H. Cain,** senior engineer with H. Zinder & Associates in Houston, have joined International Petroleum Co., Ltd. (Colombia). Pearson will be engineering group head at Cartagena, Colombia. Cain will go to Bogota as assistant engineering group head.

T. R. Corbett, managing director of Esso Standard Oil Co.'s Antwerp, Belgium refinery, has been named managing director of Esso Nederland N.V. in charge of refining activities in the Netherlands. Corbett was formerly manager of Carter Oil Co.'s Billings, Mont., refinery. **G. A. Stein, Jr.,** assistant manager of Antwerp refinery, will succeed Corbett as managing director. Stein was with the Esso refinery at Baton Rouge, La., before going to Antwerp in 1955.

Personals

Cecil Bales, tool pusher for Big Chief Drilling Co., has been transferred from Marlow, Okla., to Oklahoma City.

James C. Swarbrick, formerly geologist for Shell Oil Co., has been switched to development engineer at Shell's Ventura office.

Dr. John S. Bradley, marine geologist at the University of Texas Port Aransas Institute of Marine Science, has joined Atlantic Refining Co. in Dallas as senior research geologist.

Duane A. Crawford, associate petroleum engineer with Ohio Oil Co. at Bridgeport, Ill., has joined Pennsylvania State University as research associate.

M. H. Smith has been promoted to manager of the Bismarck branch of Northwest Geological Service replacing **George R. Stocker,** who has resigned.

George W. Chapman, manager of Sun Oil Co.'s Southwest division land department since 1951, will take over as manager of the company's Mid-Continent production division at Tulsa on the retirement of **Arthur F. Truex** January 1. Truex has been with Sun and

A. F. TRUEX

G. W. CHAPMAN

its predecessors for 32 years and has been Mid-Continent division head 12 years. He joined the organization as a geologist in 1924. Chapman also is a Sun veteran, joining the company in 1930. For several months during 1953 and early 1954, he served as acting division manager of the company's Rocky Mountain division at Denver.

R. C. McMahan, Oklahoma district engineer for Sunray Mid-Continent Oil Co., has been named assistant district superintendent for the company's Kansas district, Great Bend, Kans. **Hobson C. Mann,** Pauls Valley area superintendent, will succeed McMahan at Oklahoma City. **W. C. Chronister,** formerly of the company's engineering division in Tulsa, has been appointed senior production engineer at Midland, Tex.

W. A. Vestal, district engineer with Lion Oil Co. division of Monsanto Chemical Co. at Snyder, Tex., has been transferred as senior reservoir engineer to El Dorado, Ark.

James R. Masson, Jr., lead engineer with Standard Oil Co. of California in El Segundo, Calif., has been transferred to Socal's subsidiary, Salt Lake Refining Co., in Salt Lake City.

A. C. Rubel, president of Union Oil Co. of California, has been named a director and member of the executive committee of the Western Oil and Gas Association. He succeeds **Reese H. Taylor,** chairman of Union's board of directors.

Rear Adm. Carl G. Drescher, former director of the Armed Services Petroleum Purchasing Agency, has been named assistant director of foreign operations for Sinclair Oil Corp.

George A. Stovall, formerly with Standard Oil Co. of Texas, has joined Vickers Petroleum Co., Inc., in Wichita as head of the reservoir engineering section of the production department. **E. C. Abrahamson** has been promoted to division geologist for the company.

J. J. Willenburg, manager of Service Pipe Line Co.'s Illinois Division, has been named manager of both the Missouri and Illinois divisions following the retirement of **H. C. Jones,** Missouri division manager. **G. L. Maciula,** assistant manager of the Illinois division, will transfer to Raytown, Mo., to assist in supervision of the Missouri area.

Spencer A. Hallberg has been named division superintendent for Standard Oil Co. (Ind.) at Chicago replacing **Ray T. Scott,** who has retired. Hallberg was formerly superintendent of the company's Twin Cities, Minn., products pipeline operations, and has been acting Chicago division superintendent since 1955.

Harold F. Coil and **Jack L. Trittipo** have been transferred from Dowell Incorporated's Charleston, W. Va., area to Marietta, Ohio. Coil, area sales engineer, has been promoted to district area manager. Trittipo, formerly petroleum engineer, has been appointed district engineer. In Dowell's Tulsa offices, **James E. Reed,** development engineer, has been named assistant to the manager of the company's research and development department, and **Lloyd C. Taylor,** development engineer, has been promoted to group leader in the research and development department.

Gene A. Carter, petroleum engineer with Magnolia Petroleum Co., has been transferred from Great Bend, Kans., to Kimball, Neb.

Billy J. Langford, development engineer for Shell Oil Co., has been transferred from Midland to Salt Lake City.

Dr. Francis T. Wadsworth, head of the chemicals section of American Oil Co., Texas City, Tex., has been appointed assistant director of the company's research and development department. A graduate of the University of Missouri, Wadsworth joined American Oil in 1942.

F. K. North, acting chief geologist for California Standard Co. in Calgary, has been transferred to the California Exploration Co. in San Francisco.

Lynn Walker, reservoir engineer with Creole Petroleum Corp. in Venezuela, has joined American Maracaibo Co. as reservoir and evaluations engineer.

M. E. Menger, division geologist with Monterey Oil Co., and **Corman Hyman,** South Texas district geologist for Monterey, have both opened consultant geologist offices in San Antonio following the closing of Monterey's San Antonio geological department.

Robert Marsh, geologist with British-American Oil Producing Co., has been transferred from Denver to Billings, Mont. He replaces **Harold Harraldson,** who has resigned. **Harry Lager** has been transferred from Midland, Tex., to Denver to replace Marsh.

C. E. Schuyler, division master mechanic in Service Pipe Line Co.'s Shawnee, Okla., district, has been appointed district superintendent. He replaces **W. L. Hadley,** who has retired. **C. E. Rickey,** chief engineer at Drumright, Okla., will replace Schuyler as division master mechanic.

W. G. (Bill) Warnock, manager of materials and purchasing for the old Mid-Continent Petroleum Corp., and now purchasing department coordinator for Sunray Mid-Continent Oil Co., will retire November 1. Warnock was with the old Cosden & Co. in 1916 when the first high pressure still was built in the D-X Sunray West Tulsa refinery.

G. Robert Brandt has been named production geologist at Great Bend, Kans., for the National Cooperative Refinery Association.

V. H. Goodwin and **P. L. Lafosse** have been appointed supervising engineers, and **H. L. Post** senior design engineer at Humble Oil & Refining Co.'s Baytown, Tex., refinery.

W. Floyd Taylor has been named district foreman in charge of a production subdistrict office opened by Shell Oil Co. at Woodward, Okla.

Karl W. Shimeall, vice president in charge of refining for Crown Central Petroleum Corp., has been elected vice president in charge of southwestern operations. **Richard T. Colquette,** vice president of Pan-Am Southern Corp., has taken early retirement from that company and will succeed Shimeall as vice president in charge of refining.

J. H. LOUDON

J. H. Loudon, general managing director of Royal Dutch Petroleum Co. and chairman of the board of Shell Caribbean Petroleum Co., has been elected a director of Shell Oil Co. Loudon replaces **Dr. H. Bloemgarten** on the Shell board. Bloemgarten, who has retired, was a vice president of Shell before becoming a director of the company in 1947.

Kenneth G. Grandall has opened consulting petroleum and natural gas engineering offices in Houston. Grandall was formerly with The Texas Co. at New Orleans and Phillips Petroleum Co. in Corpus Christi, Odessa, and Beaumont, Tex.

Six scientists have joined the staff of Ohio Oil Co.'s Denver research center. They are: **Dr. Lloyd C. Pray** and **Dr. Donald R. Baker,** research geologists, **Dr. John L. Ellingboe, Dr. William S. Ferguson,** and **Dr. Charles J. Norton,** research chemists, and **Dr. Alvin L. Benham,** research engineer.

H. A. (Art) Nedom, Amerada Petroleum Corp. district engineer at Williston, N. D., has been named senior petroleum engineer in Tulsa. **J. R. Enloe,** engineer in the Tioga, N. D., area, has been promoted to district engineer and **D. E. Boone,** engineer in Lea County, New Mexico, will be transferred to Tioga.

James L. Wible has been named superintendent of Carter Oil Co.'s new production district at Billings, Mont., and transferred from St. Elmo, Ill., to Billings.

Douglas H. McGinness, formerly of National Cooperative Refining Association, has joined Apache Oil Co. as geologist in charge of the company's new Wichita district office.

Maurice B. Parmelee, office manager of the general sales department for Sun Oil Co., has been elected secretary-treasurer and a director of Sun Oil Co., Ltd. and transferred from Radnor, Pa., to Toronto.

Jack L. Mataya has been transferred by Stanolind Oil & Gas Co. from Tyler to Midland, Tex., as district geophysicist. He replaces **C. J. Long,** who was moved from Midland to Fort Worth in July as division geophysical supervisor.

A. T. Maasberg, technical director of plastics production for Dow Chemical Co., has been appointed director of research and development for Dow's Midland, Mich., division. **Arthur F. Roche,** assistant director of the Plastics Production Laboratory, will succeed Maasberg.

J. M. Brackenbury, superintendent of Shell Oil Co.'s Martinez, Calif., refinery, has been appointed manager of the New York office manufacturing technological department. **J. B. Dunlap,** assistant superintendent at the Martinez refinery, will succeed Brackenbury as superintendent. In other appointments, **J. B. St. Clair,** assistant manager of the New York office manufacturing technological department, will go to Martinez as assistant superintendent replacing Dunlap. **H. E. Walker,** chief research technologist at the company's Houston manufacturing research laboratory, will transfer to New York to succeed St. Clair.

Personals

E. J. Gemmill, southwestern division geophysicist for Cities Service Oil Co. at Fort Worth, has been appointed assistant division manager for the company's southwestern exploration division at Midland, Tex. **John M. Armstrong,** district geophysicist at Midland, will replace Gemmill as division geophysicist.

GEMMILL

ARMSTRONG

W. R. Bonds, Jr., driller with Worley & Harrell, Inc., at Ray, N. D., has joined Gabe McCall Drilling Co. in New Town, N. D.

A. C. Allyn, Jr., partner in A. C. Allyn & Co., Chicago, has been named a director of Oceanic Oil Co., Los Angeles.

Peter G. Burnett, petroleum engineer for Stanolind Oil & Gas Co. at Midland, Tex., has joined the consulting engineering firm of Ball Associates in Washington.

J. Howard Johnson, superintendent of gas and gasoline plants for The Texas Co. in Tulsa, has been named assistant manager of the liquid petroleum gas sales division. **F. E. Upton,** assistant superintendent of gas and gasoline plants, will succeed Johnson. **George M. Dunagan,** supervisor of gasoline plants, Tulsa, will replace Upton as assistant superintendent.

DEATHS

Charles L. Bacheller, 72, pioneer operator in Montana and East Texas, died August 29 in Dallas. Bacheller drilled one of the first discoveries in Montana. With profits from this strike, he moved to Texas and directed drilling operations first from Wichita Falls and later from Kilgore.

George Milton Harris, 84, retired general superintendent of crude oil purchasing for Stanolind Oil & Gas Co., died August 30 in Tulsa after a heart attack. Harris retired in 1934.

E. L. (Red) Earl, 49, New Orleans consulting geologist, died in late August. Earl was a former vice president of Monterey Exploration Co. and head of the Houston exploration office of British-American Oil Co.

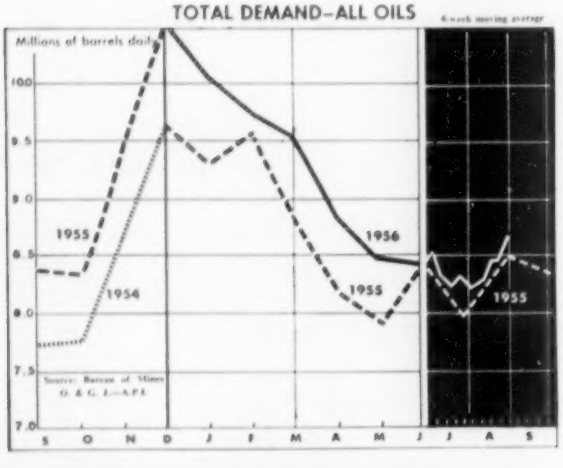
Frederick Squires, petroleum engineer emeritus of the Illinois State Geological Survey, died recently.

Frank M. Larkin, 79, owner of the Larkin-Graham Oil Co. and the Ell-Mar Oil Co., died August 5 in Tulsa.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,116,125	DOWN	15,150	UP	376,965
Crude stocks	276,907,000	DOWN	158,000	UP	17,072,000
Completions	1,090	DOWN	57	DOWN	36
Refinery runs	8,098,000	UP	155,000	UP	456,000
Gasoline stocks	175,571,000	DOWN	245,000	UP	22,279,000
Kerosine stocks	32,401,000	UP	880,000	DOWN	2,544,000
Distillate stocks	138,449,000	UP	4,068,000	UP	5,084,000
Residual stocks	46,783,000	UP	714,000	UP	196,000
Four-product stocks	393,204,000	UP	5,417,000	UP	25,015,000
Total imports	1,368,300	DOWN	119,200	UP	59,100



Low Estimates of Gasoline Demand for June Probably Influenced July Runs

WAS your preliminary estimate of total gasoline demand for June way off? If you came within 3 per cent of the final total, you were better than most figure watchers.

According to the Bureau of Mines' monthly Petroleum Statement, total demand for gasoline averaged 4,327,000 bbl. daily in June. This rate of demand represents a gain of 215,000 bbl. daily or 5.2 per cent over the average for June 1955. Calculated demand, based on preliminary weekly figures, showed an average of about 4,140,000 bbl. daily for a gain of only 0.7 per cent over the same month last year.

This important difference, shown by the two sets of figures, may have been a factor in the continuation of high refinery runs in July. Refinery runs averaged 8,071,000 bbl. daily in June and about 8,011,000 bbl. daily in July. This is the first time that runs have averaged better than 8,000,000 bbl. daily for a summer month, and the 2-month average set a new all-time record, exceeding the previous record established during January and February of this year.

Any sales manager with June sales of gasoline averaging about 6 per cent above the same period in 1955, who took a look at the 0.7 per cent national increase shown by the current figures was justified in his conclusion that he was doing better than the average. With this picture of his own position, he probably did not offer too much resistance when the manufacturing department of his company suggested that runs for July be maintained at about 6 per cent above the record for July 1955.

From the June report by the Bureau of Mines he now learns that he was not much above the average in June and that his company along with other refiners ran too much crude in July. Manufacturing departments of oil companies would like to operate as near capacity as possible since many of their costs do not vary with volumes of crude run. Fixed costs spread over more barrels per day result in lower processing cost per barrel.

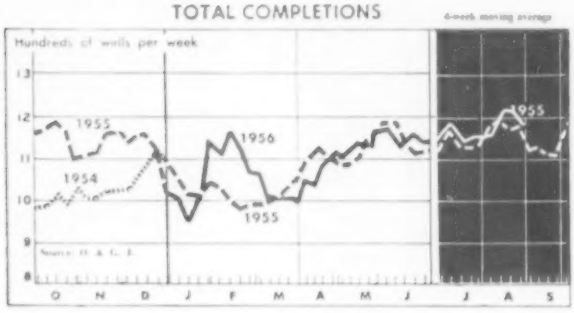
However, the gain from lower processing cost may be more than offset by lower prices for finished products. The Mid-Continent refiner is selling his spot gasoline for 0.25 cent a gallon less than he could get for it early in June.

Most of the June error in gasoline demand was due to reported stocks. For most of the first half, weekly reports of gasoline inventories were lower than the monthly reports. Finished and unfinished gasoline stocks for the end of May, calculated from the weekly reports, amounted to about 184,870,000 bbl. The actual report from the Bureau of Mines which came out about 8 weeks later, showed May 31 stocks at 186,673,000 bbl. The weekly report was about 1,800,000 bbl. low.

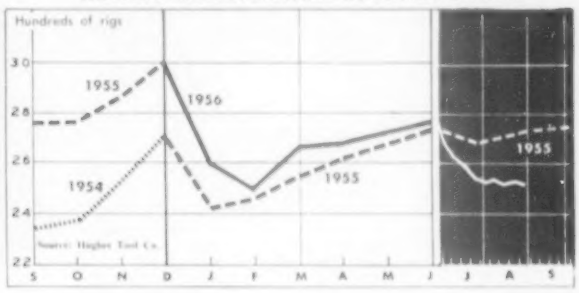
At the end of June, the weekly report carried gasoline stocks at a little more than 180,600,000 bbl. compared with 177,076,000 bbl. reported later by the Bureau of Mines. The weekly report was high by about 3,500,000 bbl. Stock withdrawals, calculated from current reports, amounted to a little less than 4,300,000 bbl. for the month of June or a little less than half the reduction of 9,597,000 bbl. shown on the monthly report.

Part of the error in calculated demand was due to the unexpected increase in gasoline imports, but this was offset by a decrease in gasoline blending outside refineries.

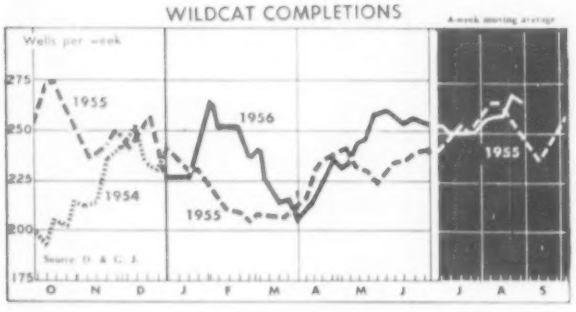
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	9-3-56	8-27-56	9-5-55
North Central and East	126	134	148
Southeast	36	34	30
Okla., Kans., Ark., Mo.	448	457	534
Louisiana	440	438	438
North and East Texas-Panhandle	367	379	388
Gulf and South Texas	235	233	258
West Texas-New Mexico	477	465	508
Rocky Mountain	281	278	327
Pacific Coast	113	118	135
Total United States	2,523	2,536	2,766
Western Canada	264	257	218

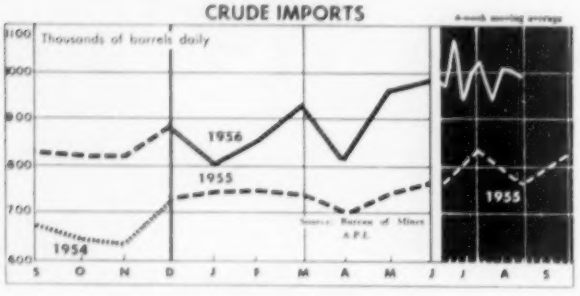
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED SEPTEMBER 1, 1956

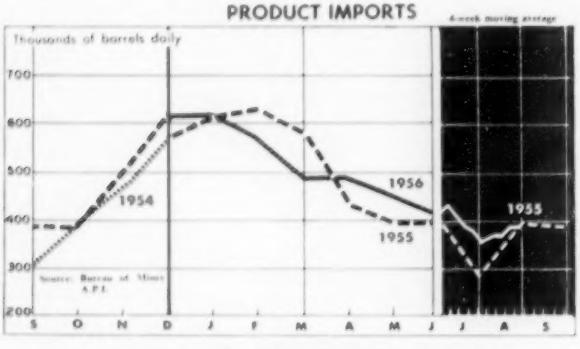
	Total of all wells					Cum		Wildcat completions and discoveries					Cumulative total, 1956				
	Comp.	Oil	Gas	Dry	Footage	1956	1955	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	2	0	0	2	6,079	75	52	0	0	0	2	2	0	0	1	32	33
Arkansas	20	14	0	6	63,997	575	530	0	0	0	3	3	27	0	3	94	124
California	43	21	4	18	203,971	1,477	1,666	0	0	0	15	15	32	0	6	299	337
Colorado	17	3	0	14	76,848	779	983	0	0	0	13	13	18	0	11	372	401
Illinois	76	38	1	37	175,479	2,576	2,553	1	0	0	16	17	35	0	3	468	506
Indiana	18	8	0	*10	31,461	440	499	0	0	0	2	2	13	0	1	77	91
Kansas	91	37	6	†48	339,299	3,418	3,399	0	0	1	23	26	82	2	23	616	723
Kentucky	29	9	1	19	40,655	1,213	969	2	0	0	8	10	28	0	1	259	288
Louisiana	57	31	5	21	474,016	2,572	2,645	1	1	0	14	16	81	38	43	357	519
North	24	14	2	8	108,972	1,099	1,381	1	0	0	6	7	22	2	3	146	173
South	29	15	2	12	327,756	1,182	1,264	0	1	0	7	8	47	32	28	185	292
Offshore	4	2	1	1	37,288	291		0	0	0	1	1	12	4	12	26	54
Michigan	9	5	0	4	28,303	297	353	0	0	0	4	4	6	0	1	104	111
Mississippi	7	3	0	4	47,563	297	314	0	0	0	3	3	12	1	1	127	141
Montana	10	5	0	5	46,220	286	227	0	0	0	4	4	10	0	1	94	105
Nebraska	13	3	0	10	79,136	680	534	0	0	0	7	7	27	0	0	304	331
New Mexico	50	18	23	9	205,499	1,316	1,119	2	0	1	5	8	35	0	7	134	176
Northwest	30	4	22	4	110,761	538	361	1	0	1	3	5	6	0	6	43	55
Southeast	20	14	1	5	94,738	778	758	1	0	0	2	3	29	0	1	91	121
North Dakota	8	5	0	3	54,388	171	160	0	0	0	2	2	8	0	0	45	53
Ohio	35	17	6	12	66,264	692	800	0	0	0	0	0	0	0	1	5	6
Oklahoma	141	74	6	‡61	523,433	5,767	5,937	3	0	1	9	13	85	16	28	469	598
Pennsylvania-New York	4	0	4	0	13,835	754	1,088	0	0	1	0	1	0	0	6	11	17
Texas	425	269	22	134	1,879,406	15,082	13,593	16	1	6	89	112	514	26	125	3,156	3,821
Southwest (1 & 4)	50	28	5	17	189,265	2,172	2,075	3	0	0	10	13	95	5	43	587	730
Gulf Coast (2 & 3)	53	18	7	28	328,146	1,789	1,709	0	0	3	19	24	48	13	46	469	576
East (5 & 6)	22	8	1	13	111,004	776	663	0	1	0	11	12	11	2	5	266	284
N. Central (7-B & 9)	151	81	5	65	520,640	5,397	5,125	9	0	0	42	51	226	0	6	1,278	1,510
West (7-C & 8)	120	111	0	9	606,265	4,046	3,331	4	0	0	7	11	122	0	9	511	642
Panhandle (10)	29	23	4	2	124,086	902	690	0	0	1	0	1	12	6	16	45	79
Utah	2	0	0	2	7,046	85	64	0	0	0	2	2	3	0	3	45	51
West Virginia	16	3	13	0	40,357	440	417	0	0	1	0	1	0	0	6	7	13
Wyoming	17	11	1	5	67,895	554	564	0	0	0	2	2	9	0	7	135	151
Miscellaneous	0	0	0	0	0	70	21	0	0	0	0	0	4	0	0	58	62
Total United States	1,090	574	92	424	4,471,150	39,616	38,487	25	2	13	223	263	1,029	83	278	7,268	8,658
Total previous week	1,147	576	84	487	4,594,258			26	2	5	248	281	1,004	81	265	7,045	8,395
Total Sept. 3, 1955	1,126	611	79	436	4,555,657			25	0	8	209	242	1,105	135	244	6,660	8,144
Cumulative 1956	39,616	21,559	2,720	15,337	159,521,977												
Western Canada	95	71	6	18	446,521	1,994											

Service wells included: *2, †4, ‡7.

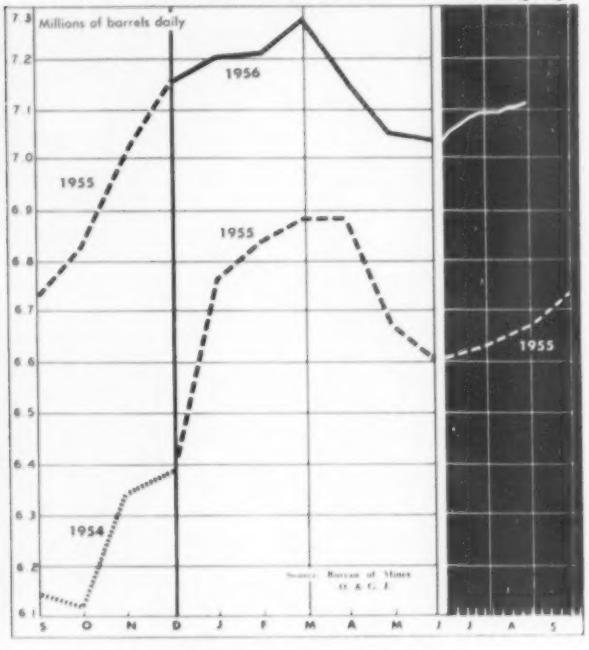
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

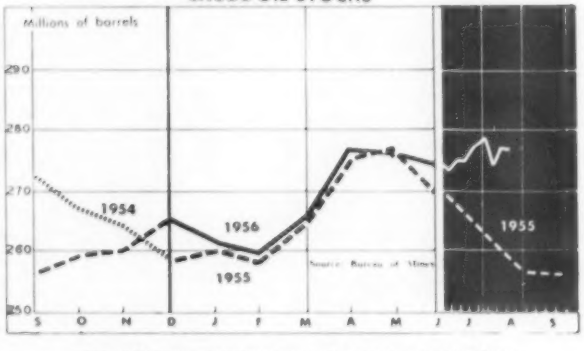


DAILY AVERAGE PRODUCTION FOR WEEK

	September, 1, 1956			Aug. 25
	Crude oil	Lease condensate	Total	total
Alabama	7,400		7,400	7,500
Arkansas	79,600	400	80,000	79,700
California	962,300		962,300	961,100
Colorado	157,100		157,100	161,400
Eastern	50,800		50,800	51,400
Florida	1,375		1,375	1,375
Illinois	234,300		234,300	231,000
Indiana	30,900		30,900	30,800
Kansas	339,500		339,500	344,200
Kentucky	47,700		47,700	47,300
Louisiana	733,200	55,500	788,700	788,550
North	119,200	2,000	121,200	121,050
South	614,000	53,500	667,500	667,500
Michigan	29,300		29,300	29,100
Mississippi	107,900	4,650	112,550	112,550
Montana	63,100		63,100	63,400
Nebraska	37,200		37,200	39,300
New Mexico	229,100	3,800	232,900	232,800
North Dakota	37,500		37,500	36,400
Oklahoma	579,500		579,500	591,200
Texas	2,980,500	47,800	3,028,300	3,028,300
Dist. 1	56,000	425	56,425	56,425
Dist. 2	146,000	7,925	153,925	153,925
Dist. 3	436,000	22,400	458,400	458,400
Dist. 4	239,000	5,700	244,700	244,700
Dist. 5	43,000	350	43,350	43,350
Dist. 6	125,000	5,300	130,300	130,300
East Texas Field	210,500		210,500	210,500
Dist. 7-B	158,000	50	158,050	158,050
Dist. 7-C	190,000	3,700	193,700	193,700
Dist. 8	1,060,000	1,500	1,061,500	1,061,500
Dist. 9	217,000	300	217,300	217,300
Dist. 10	100,000	150	100,150	100,150
Utah	7,100		7,100	7,000
Wyoming	288,400		288,400	286,600
Others	‡200		‡200	300
Total U. S.	7,003,975	112,150	**7,116,125**	7,131,275
Change from previous week, down			**15,150**	
Canada	†504,000		†504,000	†524,900
Total U. S. production January 1-September 1			1,751,413,025 bbl.	
Same period last year (crude plus cond.)			*1,645,518,416 bbl.	

*Includes 27,360,050 bbl. condensate. †Week ended previous Monday. ‡Nevada.

CRUDE-OIL STOCKS



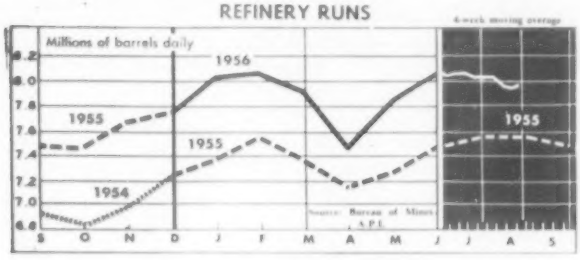
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

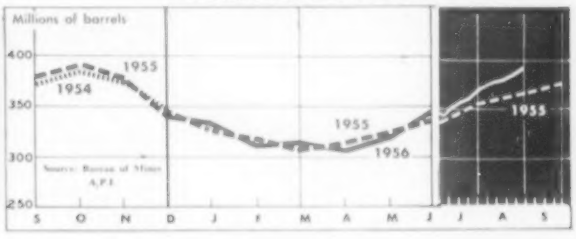
	8-25-56	8-18-56	8-27-55
Pennsylvania Grade	2,554	2,583	3,085
Other Appalachian	2,084	2,412	1,995
Illinois, Indiana, Michigan	10,822	10,907	10,682
Nebraska, North Dakota	2,360	2,188	2,207
Kansas	9,012	9,045	8,312
Oklahoma	27,231	27,428	21,454
Arkansas	2,707	2,644	2,841
Louisiana	17,181	16,470	16,482
North	2,688	2,674	2,794
South	14,493	13,796	13,688
Mississippi	2,991	3,261	2,793
New Mexico	7,673	7,880	7,876
Texas	121,754	123,854	121,293
East Texas proper	9,359	9,528	9,520
West Texas	58,633	60,172	57,405
Texas Gulf	22,348	22,513	23,530
Other Texas	31,414	31,641	30,838
Wyoming	19,158	19,802	14,968
Other Rocky Mountain	7,291	6,754	5,172
California	28,789	28,034	29,890
Foreign	15,300	13,803	10,785
Total	276,907	277,065	259,835

*Bureau of Mines. Includes 4,047,000 bbl. in California.

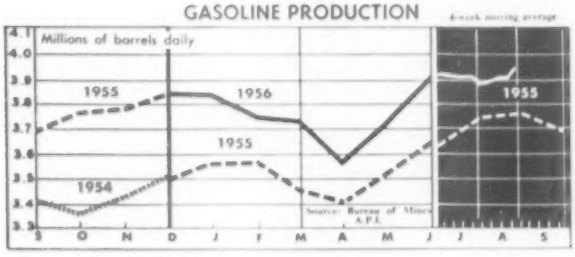
REFINERY RUNS



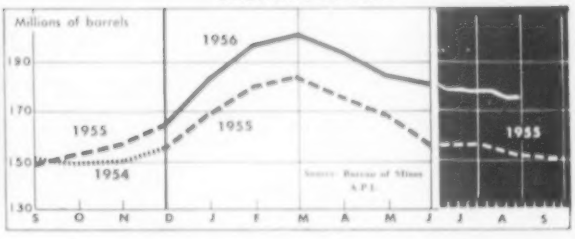
FOUR-PRODUCT STOCKS



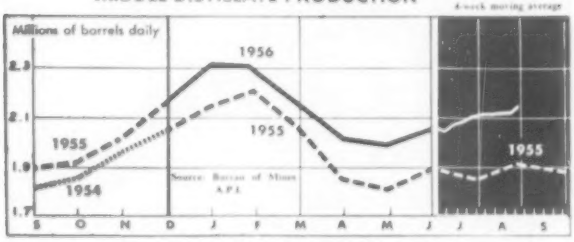
GASOLINE PRODUCTION



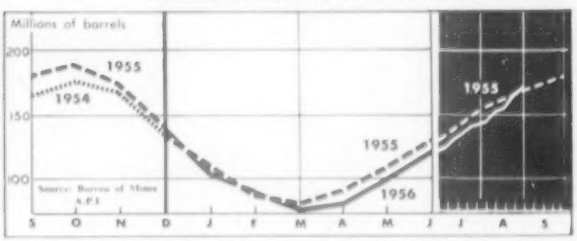
GASOLINE STOCKS



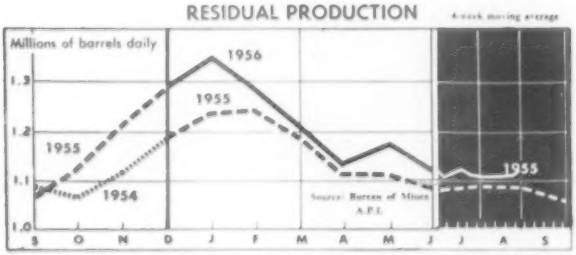
MIDDLE-DISTILLATE PRODUCTION



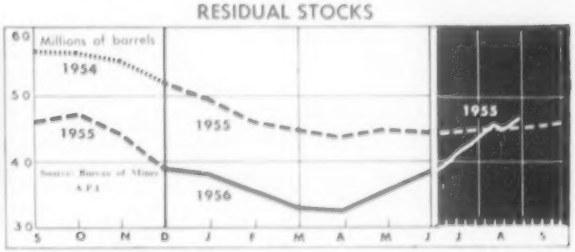
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, AUGUST 31, 1956

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks† Gaso.‡	Kero.	Dist.	Resid.	Bureau of Mines, August 1955 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,141	517.6	33.9	326.0	187.6	42,706	12,050	49,693	12,458	1,056	454.6	23.4	268.0	193.0
Appalachian:														
District 1	105	43.9	3.4	24.9	5.0	4,468	612	3,023	580	92	38.1	3.8	21.7	5.0
District 2	112	56.7	5.0	18.6	15.7	2,966	788	987	501	100	56.4	2.6	11.5	13.2
Ind., Ill., Ky.	1,469	744.7	64.7	315.1	155.9	31,669	7,079	20,079	5,359	1,372	735.2	65.8	263.1	146.6
Minn., Wis., Dak.	73	34.1	8.0	18.3	5.7	6,226	1,538	7,962	200	(5)	(5)	(5)	(5)	(5)
Okla., Kans., Mo.	704	390.6	14.2	173.3	16.3	14,919	2,050	13,372	1,560	686	389.6	15.3	157.8	20.7
Inland Texas	290	206.6		58.8	27.6	7,112	513	1,953	1,684	257	181.3	8.4	51.3	20.8
Texas Gulf Coast	1,925	933.1	103.0	518.8	238.3	23,731	3,798	16,560	6,214	1,864	887.8	102.0	436.7	256.3
La. Gulf Coast	706	388.6	63.4	179.3	49.7	9,850	2,628	6,538	1,826	676	341.2	51.7	173.3	48.7
N. La. and Ark.	100	38.6	4.9	25.6	5.3	4,845	601	1,896	186	94	35.9	7.3	22.6	5.8
Rocky Mountain:														
New Mexico	23	12.3	0.4	4.6	2.7	434	7	115	26	21	11.4	0.2	3.7	3.2
Other Rocky Mtn.	286	137.4	5.4	59.7	37.1	5,449	415	3,366	887	278	130.0	3.7	58.0	37.3
West Coast	1,164	525.8	7.4	168.6	369.1	21,256	322	12,905	15,302	1,084	511.2	5.3	152.9	339.5
Aug. 31, 1956	8,098	4,030.0	313.7	1,891.6	1,136.0	175,571	32,401	138,449	46,783	7,380	3,772.7	289.5	1,620.6	1,090.1
Aug. 24, 1956	7,943	3,931.9	287.0	1,859.1	1,118.9	175,816	31,521	134,381	46,669					
Sept. 2, 1955	7,642	3,740.4	282.7	1,652.4	1,068.9	153,292	14,945	133,365	46,587					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines. §Included in Ind., Ill., Ky.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (88 octane)	11.25-11.75
Premium (96 octane)	13.00-13.50
Gulf Coast (cargoes for coastwise or export movement):	
Regular (90 octane)	11.00-11.50
Regular (92 octane)	11.25-11.75
Premium (97 octane)	12.75-13.25
Premium (98 octane)	13.00-13.50
California—Los Angeles (rack):	
Regular (84 octane)	12.6-13.3
Premium (93 octane)	14.7-15.3
Caribbean area (cargoes):	
Regular (87 octane)	10.50
Premium (93 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grades 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.75-10.00
Diesel oil (58 d.i. and above)	9.625-9.875
Distillate No. 1	9.625-9.875
Distillate No. 2	8.75-9.00
Gulf Coast (cargoes):	
Kerosine 41-43	9.125
Distillate No. 2	8.50
New York Harbor (barges):	
Kerosine 41-43	10.85
Distillate No. 2	10.35
Diesel fuel, 48-52 d.i.	10.65
Caribbean area (cargoes):	
Distillate No. 2	8.50

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$2.00-2.10
Gulf Coast (cargoes):	
Bulker C fuel	$2.10
New York Harbor (barges):	
Bunker C fuel	$2.80
Caribbean (cargoes):	
Bunker C at Aruba, N.W.I.	$2.10
California (rack):	
Bunker C fuel, Los Angeles	$2.15-2.25

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	24
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.75
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	27
200 vis. neutral (180 at 100°), 25 p.t.	25

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.02				
15-15.9	2.08				
16-16.9	2.13				
17-17.9	2.19				
18-18.9	2.24				
19-19.9	2.30				
20-20.9	2.35	$2.50		$2.37	
21-21.9	2.41	2.52		2.39	
22-22.9	2.47	2.54		2.41	
23-23.9	2.52	2.56		2.43	
24-24.9	2.58	2.58	$3.01	2.45	
25-25.9	2.64	2.60	3.03	2.47	$2.13
26-26.9	2.69	2.62	3.05	2.49	2.19
27-27.9	2.76	2.64	3.07	2.51	2.24
28-28.9	2.83	2.66	3.09	2.53	2.29
29-29.9	2.91	2.68	3.11	2.55	2.34
30-30.9	2.97	2.70	3.13	2.57	2.39
31-31.9	3.04	2.72		2.59	2.44
32-32.9	3.12	2.74		2.61	2.48
33-33.9	3.20	2.76		2.63	2.52
34-34.9	3.27	2.78		2.65	2.56
35-35.9	3.34	2.80		2.67	2.60
36-36.9	3.39	2.82		2.69	2.64
37-37.9		2.84		2.71	2.66
38-38.9		2.86		2.73	2.68
39-39.9		2.88		2.75	2.70
40 and up		2.90		2.77	2.72

*Includes Oklahoma, Kansas, North Dakota, West Texas (sweet), North Central Texas, North Louisiana, Arkansas. †Low-cold-test Gulf Coast. ‡Sour.

Effective dates: California, February 7, 1956; east of California, June 15, 1953; Pennsylvania Grade, August 16, 1956.

Some crudes in North Central Texas, West Central Texas, and Texas Panhandle have been shifted to the intermediate schedule with $2.83 for 40° and 2 cents per degree drop. Effective dates range from July 15, 1956, to August 10, 1956.

FLAT PRICES

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	4.68
Middle District	4.50
Southwest Pennsylvania	4.21
West Virginia	4.03
Buckeye Grade	4.07
Zanesville Grade	3.15
Illinois Basin	2.90
Canada:	
Leduc-Woodbend (flat prices D-2, D-3)	2.60
Redwater (Alta.) D-3	2.49
Smiley-Viking (Sask.)	2.26
Fosterton (Sask.)	1.29
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-49.8°, Tucupido	*3.40
San Joaquin, 41°-41.9°, Puerto La Cruz	*3.04
Oficina, 35°-35.9°, Puerto La Cruz	*2.80
Tia Juana medium, 26.5°-26.9°, Amuay§	‡2.30
Quiriquire, 16.5°-16.9°, Caripito	‡2.21
Lagunillas heavy, flat, Amuay or Las Piedras§	2.05
Bachaquero, 16.5°-16.9°, Amuay or Las Piedras§	‡1.90

*Plus or minus 2 cents per barrel for each degree gravity change. †Plus or minus 2.5 cents per barrel for each half-degree gravity change. ‡Plus or minus 3.5 cents per barrel for each half-degree gravity change. §Also available at La Salina at 3.0 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0°-34.9°, Abadan	1.86
Iraq, 36.0°-36.9°, Fao	1.87
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.46
Iraq, 36.0°-36.9°, Tripoli, Banias	2.46
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ Gulf-U.S.N.H., dirty (USMC+55%)	$4.42
★ N.W.I.-U.S.N.H., dirty (USMC+57.5%)	4.25
★ Lebanon-U.K., dirty (Scale+145%) (69s. 5d.)	9.66
★ P.G.-U.S.N.H., dirty (USMC+60%)	20.32
P.G.-France, dirty (USMC+75%)	19.08

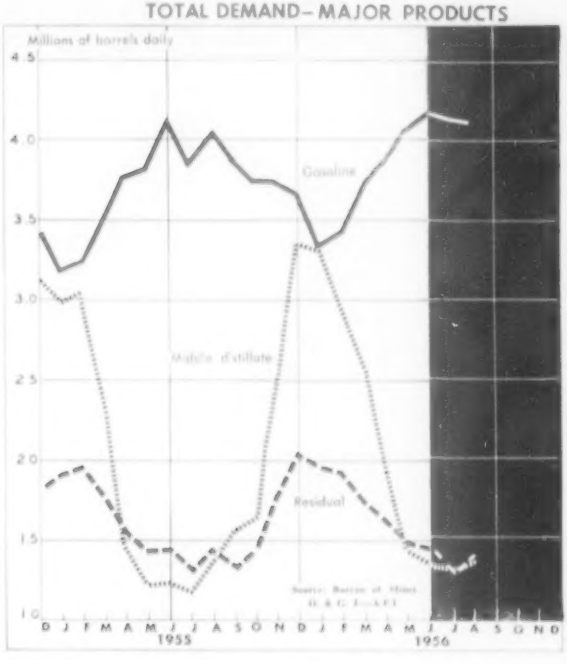
SUPPLY AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

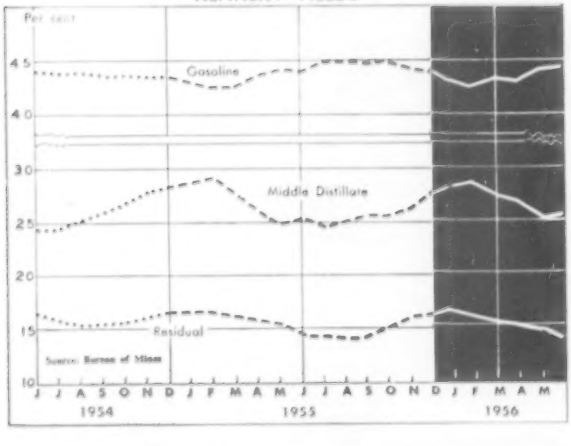
	Total demand	Refinery production	Stocks end of period†
GASOLINE			
August 1956*	4,108	3,947	175,570
July 1956*	4,122	3,899	177,350
June 1956	4,327	3,880	177,076
September 1955	3,877	3,696	150,194
August 1955	4,033	3,773	151,912
KEROSINE			
August 1956*	208	312	32,400
July 1956*	192	301	29,300
June 1956	153	290	26,111
September 1955	244	279	36,361
August 1955	207	293	35,292
DISTILLATE			
August 1956	1,155	1,831	138,450
July 1956*	1,099	1,806	116,850
June 1956	1,180	1,755	93,758
September 1955	1,322	1,621	143,248
August 1955	1,170	1,621	133,675
RESIDUAL			
August 1956*	1,400	1,122	46,780
July 1956*	1,283	1,106	43,980
June 1956	1,412	1,098	39,073
September 1955	1,350	1,061	46,267
August 1955	1,439	1,090	45,480

*Preliminary. †Thousands of barrels.

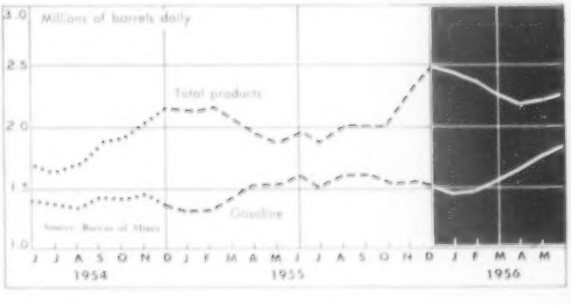
TOTAL DEMAND—MAJOR PRODUCTS



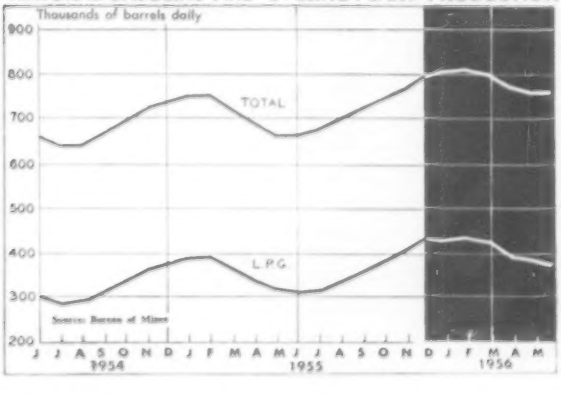
REFINERY YIELDS



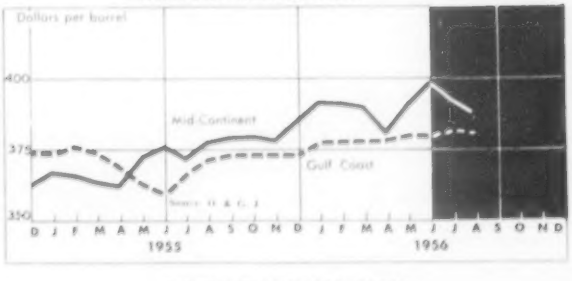
PRODUCTS DELIVERED BY PIPELINE



NATURAL-GASOLINE AND CYCLING-PLANT PRODUCTION



REFINERY REALIZATION



REFINERY REALIZATION

	Aug.* 1956	July* 1956	June 1956	Aug. 1955
Mid-Continent	$3.87	$3.91	$3.95	$3.77
Gulf Coast	3.81	3.82	3.81	3.72

*Preliminary.

Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel oil, and residual as published in The Oil and Gas Journal.

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OIL WELL TUBING, SPOT DELIVERY 50,000' 2⅜" 4.6# Brand New E.W. Non Upset 10RD Thread T&C 3000 PSI average 16' lengths or will power buck 2 joints together to make range 2, at $.49 PFT, and 45,000' 2⅜" OD 4.7# Brand New E.W. External Upset 8RD Thread T&C 3000 PSI average 16' lengths, or will power buck 2 joints together to make Range 2, at $.59 PFT FOB St. Louis. Also have several strings 7" and 9⅝" OD Casing available as well as other sizes of casing and tubing. For details contact: A. J. STRUBEL, 4946 Murdoch, St. Louis 9, Mo. Office Phone: PRospect 2-2100. Residence: FLanders 1-8152.

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3—500 H.P. Clark Bros. RA-5 Angle Compressors.
2—400 H.P. Clark Bros. RA-4 Angle Compressors.
1—300 H.P. Clark Bros. RA-32 Angle Compressor.
4—200 H.P. Clark Bros. Horizontal Compressors.
2—I-R Model XOB Duplex Belt Driven Compressors, skidded.
5—G-R C-240, 125# atmospheric cooling sections.

Repair parts for Clark Bros., Cooper-Bessemer and Superior Gas Engine Compressors—compressor cylinders of various makes and sizes.

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10—Kellogg Adm. Fltg. Hd. 2700, 2200, 1800 Sq. Ft.
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2 Worth LTC-6 800 hp.
1 Worth LTC-3 400 hp.
3 Penn Comps 100 CFM 500 lbs. 385 CFM 160 lbs.

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6—Adm. 785, 742, 425 sq. ft. ht. exch.
30—304 SS shell & tube condensers 100-1000 sq. ft.
Lab Petro-Chem furnace 50,000 BTU/hr.
800 ft. of 2" 4-6 ch pipe.
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This rig has been well maintained, is in good condition and ready to make hole to 4500'. Inventory, inspection and price upon request.
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BOX J-694,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

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OIL INDUSTRY Employment Service, 405 Tuloma Bldg., Tulsa, Okla. Tom Robinson, owner. Send brief resume education, experience, age, family status.

PETROLEUM ENGINEER—2 to 3 years experience in drilling and production by aggressive independent. Unusual opportunities for qualified man. Furnish resume of experience and education, all replies confidential. Corpus Christi area. Reply to Box J-695, The Oil and Gas Journal, Tulsa, Oklahoma.

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Growing independent oil company wants petroleum engineer with three to six years of practical, technical, and administrative experience for position in operations planning and control section. Some knowledge of valuation work and oil and gas law would also be helpful. Reply should furnish details on education, experience, and references, and state age and required starting salary.

BOX J-704,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

PETROLEUM ENGINEERS

Major Oil Company has openings in Production Dept. in Venezuela for a number of graduate petroleum engineers.

OPENINGS also for petroleum, mechanical and chemical engineers for work in drilling, pipeline and gas depts. Salary commensurate with experience.

Please send details of Experience to:

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HYDRAULIC CASING pulling unit operators and helpers. Call GLadstone 3-6551, Great Bend, Kansas.

FOREIGN DOMESTIC EMPLOYMENT. List oil companies, drilling contractors, showing where apply foreign jobs $5.00 cash. List 100 large domestic oil companies $5.00 cash. OIML Co., Box 2603, Tulsa, Okla.

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With degree in Physical Chemistry or Chemical Engineering plus 5 years' petroleum production engineering experience which should include 2 years' study of reservoir fluid behavior.

Salaries commensurate with training and experience. Write outlining personal history and work experience. Please include telephone number.

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Industrial Relations Division

BECHTEL CORPORATION

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Joe Braddick, FAirfax 3-2401, Houston, Texas
Bill Milligan, TUcker 1549, Los Angeles, Calif.
Don Palmer, DOuglas 2-4032, San Francisco, Calif.

HELP WANTED

WE DESIRE a man under 35 years of age with preferably a minimum of 2 years university education, familiar with all phases of water well supply systems to become Field Manager of a Mid-Western firm. Reply in your handwriting, enclosing photograph and experience record to Box J-699, The Oil and Gas Journal, Tulsa, Oklahoma.

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MAINTENANCE SERVICES
Foreign Employment

To assist and advise operating management on all maintenance services and practices in major oil installation located in Saudi Arabia.

Must be graduate engineer with minimum of 10 years' planning and operations experience in heavy industrial and refinery installations. Proven supervisory ability and thorough knowledge of maintenance craft methods and equipment required. Minimum salary $1000 monthly plus allowances and generous benefits. Excellent promotional opportunities.

Write outlining personal history and work experience. Please include telephone number.

Recruiting Supervisor, Box 183

ARABIAN AMERICAN OIL COMPANY
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NEW YORK 22, NEW YORK

HELP WANTED

GRADUATE PETROLEUM ENGINEER. 4 to 6 years experience in drilling and production phases, for Oil Division of large substantial mining concern. Excellent growth potential! Base location, Denver, Colorado. Box J-698, The Oil and Gas Journal, Tulsa, Oklahoma.

RESERVOIR ENGINEER

Strong, active independent oil company with diversified production in U.S.A. and Canada has excellent opportunity for a graduate engineer having 3-5 years of experience in reservoir analysis. Location—head operations office, South Texas. All replies confidential. Send details of education and experience, with an idea of salary expected, to

Box J-688,
The Oil and Gas Journal,
Tulsa, Oklahoma.

VALUATION ENGINEER

Petroleum Engineer with experience in appraisal and reservoir work wanted by permanently established independent oil company. Position requires practical as well as technical knowledge in the evaluation and financing of producing property purchases, and in administrative procedure. Must have the ability and initiative to develop necessary contacts in the active regions of the oil country. Reply should state age, education, experience, active references, and starting salary required.

BOX J-690,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

HELP WANTED

SALES ENGINEER For California Oil Fields. Must have wide experience in selling, servicing, engineering and supervision of the installation of equipment for the treating, dehydrating, separating and handling of petroleum production. Chemical or petroleum production engineer preferred. Offshore production equipment experience helpful. Give complete details in first letter and salary requirements. Box J-709, The Oil and Gas Journal, Tulsa, Oklahoma.

RESERVOIR ENGINEER—Anderson-Prichard Oil Corporation has an opening in its Oklahoma City office for a reservoir engineer having a thorough knowledge of field operations. Applicants should write giving a personal history, resume of education and professional experience and salary expected. All applications will be confidential. Please address Anderson-Prichard Oil Corporation, Liberty Bank Building, Oklahoma City 2, Oklahoma. Attention: Mr. D. F. Tver, Industrial Relations Department.

DRILLING ENGINEERS
FOREIGN DRILLING OPERATION

Oil well drilling contractor has immediate opening for drilling engineers in Sicily and Africa. Liberal salary and bonus. Box J-679, The Oil and Gas Journal, Tulsa, Oklahoma.

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WANT TO BUY—Oil Properties, settled or semi-settled production. 100 to 5,000 barrels daily in Oklahoma and Kansas. Contact Morris Sitrin, 1215 First National Building, Tulsa, Oklahoma.

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Bee County: Renwar Oil Corp. 9 McCoy Trustee, T. Simmons Sur., A-292. Shut-in gas well, no gage, perforations 2,372-78 ft. TD 2,430 ft. (New gas reservoir and extension in Berclair area.)

Tidewater Oil Co. 1 Manning, J. Poitevent Sur., A-263. Shut-in. gas well, no gage, perforations 7,179-7,257 ft. TD 8,202 ft. (New field—1 mile SW of Maley field.)

Fort Bend County: Harrison & Carpenter 1 Knight, Jessee H. Cartwright Sur., A-6. IP 93.96 BOPD, 3/8-in., 38°, perforations 8,248-52 ft. TD 8,282 ft. (New field.)

Harris County: W. A. Moncrief 1 Wheelis-Powers Unit, Victor Blanco Sur., A-2, in Lot 14, Blk. 4. IP 16,500 M.c.f. daily, open-flow potential, GLR 33,600 cu. ft. per bbl., 59°, perforations 9,054-66 ft. TD 9,135 ft. (New field—1½ miles SW of Alco-Mag field.)

David L. Gordon 2 Johnston, Simon Contreras Sur. IP 8,000 M.c.f. daily, open-flow potential, perforations 6,979-84 ft. TD 7,305 ft. (New reservoir—separated by faulting from Durkee and West Aldine fields.)

Jasper County: Slick Oil Corp. 1 Hughes Henry Webb Sur., A-42. IP 131.31 BOPD, 7/64-in., 37.7°, perforations 6,714-20 ft. TD 7,922 ft. (New reservoir —¾ mile northeast of West Castillo area.)

Lavaca County: North Central Oil Corp. 1 Upchurch, E. W. King Sur., A-660. IP 4,300 M.c.f. daily, open-flow potential, GLR 46,500 cu. ft. per bbl., 50.1°, perforations 8,520-40 ft. TD 9,025 ft. (New field.)

Live Oak County: Ralph Evans and Frank C. Kallina 1 Cartwright, G. W. Wright Sur., A-473. IPP 60 BOPD, 40°, perforations 4,429½-36 ft. TD 4,523 ft. (New field.)

Matagorda County: Farnsworth & Chambers Co., Inc., 1-B Huebner, Peter Bertrand Sur. IP 28 BOPD, (net) 13/64-in., 33.4°, perforations 9,371-75 ft. TD 11,388 ft. (New pay in Lucky field.)

Orange County: Michel T. Halbouty 1 Chandler, James Dyson Sur. IP 157.50 BOPD, 9/64-in., 36.1°, perforations 6,004-12 ft. and 6,016-20 ft. (Marginulina). TD 8,930 ft. (New pay in Orange field.)

Wharton County: Anderson & Cooke 1 Wittig, WCRR Sur., A-588. IP 5,700 M.c.f. daily, open-flow potential, perforations 4,416-21 ft. TD 5,210 ft. (New reservoir and extension in North Louise area.)

Lenoir M. Josey, Inc., 1 Urbanec, Thomas Slaughter Sur., A-59. IP 28,400 M.c.f. daily, open-flow potential, dry gas, perforations 4,174-86 ft. TD 7,589 ft. (New pay in North Hungerford field.)

WEST TEXAS

Crane County: Midwest Oil Corp. 1 Connell Est., 8 miles southwest of Penwell in Sec. 16, Blk. B-22, PSL. IPP 77 BOPD, 28°, perfs. 4,596-4,642 ft. TD 9,730 ft. (Glorietta discovery of C-Bar, W. (Glor).

Ector County: Gulf Oil Corp. 1 O. W. Pool "B," 3 miles east of Odessa in Sec. 31, Blk. 41, T-2-S, T&P Sur. IPF 131 BOPD, 20/64-in. choke, 35°, Wolfcamp perfs. 8,900-50 ft. TD 31,486 ft. (Oil discovery).

Magnolia Petroleum Co. 1 Sallie W. Ratliff, 5 miles northeast of Odessa in Sec. 38, Blk. 42, T-1-S, T&P Sur. IPF 83 BOPD, ½-in. choke, 45.8°, Devonian 12,130-12,208 ft. TD 13,865 ft. GOR 3108:1. (Devonian oil discovery).

Garza County: Ashmum & Hilliard 2 Ltd., 1 Ralph Welch, 11 miles northeast of Post in Sec. 13, Blk. 4, K. Aycock Sur. IPP 35 BOPD, 36.2°, Glorietta 3,143-58 ft. TD 3,807 ft. (Oil discovery).

Neville G. Penrose, Inc., and R. S. Anderson 1-X Miller, 3 miles west of Justiceburg in Sec. 39, Blk. 6, H&GN Sur. IPF 326 BOPD, ¾-in. choke, 37°, Strawn perfs. 7,616-24 ft. TD 8,076 ft. (Discovery well of Rocker "A" Strawn field).

ADVERTISERS IN THIS ISSUE

Alco Products, Inc. 41
Allen-Bradley Co. 180
Allis-Chalmers Mfg. Co. 32
Allis-Chalmers, Construction Machinery Division 150, 151
Aluminum Co. of America 15, 36
American Iron & Machine Works Co. 27
American Manufacturing Co. of Texas 7, 89
Armco Drainage & Metal Products, Inc 38
Armstrong Bros. Tool Co. 157
Automatic Sprinkler Corporation of America 173
Axelson Manufacturing Company, A Division of U. S. Industries, Inc. 129, 130, 131, 132
B and W Inc. 169
Baash-Ross Tool Company 197
Baird Mfg. Co. 206
Baker Oil Tools, Inc. 74
Barold Division, National Lead Co. 213, 214, 215, 216
Barrett Division Allied Chemical & Dye Corporation 49
Beacon Petroleum Company 66
Beaird Company, Inc., The J. B. 37
Bendix Aviation Corporation 54
Bendix Aviation Corporation, Pacific Division 19
Bethlehem Steel Co. 148
Black, Sivalls & Bryson, Inc. 46, 47
Bos-co Equip't Eng'r'g & Mfg. 154
Broderick & Bascom Rope Co. 162
Butler Manufacturing Company 61
Cameron Iron Works, Inc. 44
Chevrolet Motor Div., General Motors Corp. 16, 17
Clark Bros. Co. One of the Dresser Industries 12, 13
Classified Advertising 226, 227, 228, 229, 230
Climax Engine and Pump Mfg. Co. 21
Continental Supply Co., The 161, 162
Coppus Engineering Corp. 5
Crane Co. 95
Crose Manufacturing Co., Inc., M. J. 160
Cutler-Hammer, Inc. 40
Davison Chemical Company Division of W. R. Grace & Co. 174
Diamond Bit & Coring Co. 206
Diamond Calk Horseshoe Co. 203
Dow Chemical Company, The 123
Dowell Incorporated 140, 200, 201, Inside Back Cover
Dresser Manufacturing Division 196
Drilling & Service, Inc. 210
Edward Valves, Inc. 153
Elgen Corporation, The 198
Elliott Company 50
Emsco Manufacturing Company 72
Ethyl Corporation 102, 103
Fabri-Valve Company of America 211
Geophysical Service, Inc. 100
Glitsch & Sons, Inc., Fritz W. 64
Goodrich Chemical Company, B. F. (Geon) 9
Grancell, I. H. 153
Gulberson Corporation 184
Halliburton Oil Well Cementing Co. Inside Front Cover, 97
Hamer Valves, Inc. 67
Hercules Tool Company 188
Houdry Process Corporation 146
Houston Contracting Company 168
Houston Oil Field Material Company, Inc. 62
Hughes Tool Co. Back Cover
Hutchison Manufacturing Co. 203
Inferno Co., The 154
Infilco Incorporated 144
International Harvester Co. 24, 25
International Paints (Export), Ltd. 159
Jacobson, E. C. 157
Jefferson Chemical Company, Inc. 178
Johnston Testers, A Subsidiary of Schlumberger Well Surveying Corp. 170, 171
Jones & Laughlin Steel Corporation Supply Division 155
Jones Company, The S. M. 31
Jordan Corporation Division of OPW Corporation 33
Larkin Packer Company, Inc. 11
Lone Star Cement Corporation 208, 209
Lufkin Foundry & Machine Co. 76
Macco Oil Tool Co. 18
Mack Trucks, Inc. 169
Magnet Cove Barium Corp. 194
Manning, Maxwell & Moore, Inc. 143
Manton-Gaulin Manufacturing Company, Inc. 176, 177
Marathon Corporation 30
Marley Company, Inc., The 71
Marsh Instrument Co. 39
Mid-Continent Supply Company 48
Midwestern Pipe Line Products Co. 10
Mission Mfg. Company 157
Moore Corporation, Lee C. 124, 125
Mutual Chemical Division, Allied Chemical & Dye Corporation 179
National Bank of Commerce, The 181
National Bank of Tulsa 23
National Supply Co., The 191
National Tank Company 55, 56, 57, 58
New York Belting & Packing Co. 232
Nordberg Mfg. Co. 161
Norris Manufacturer, Inc., W. C. 154, 199
Oil and Gas Journal, The 4
Oil Base, Inc. 203
Oil Center Tool Co. 34
Oil Well Supply Division 59
OPW Corporation 6
Orbit Valve Company 11
Osborn Manufacturing Company, The 65
Otis Pressure Control, Inc. 63
Parkersburg Rig & Reel Co. 192, 193
Peerless Pump Division of Food Machinery & Chemical Corporation 207
Peerless Supply Co., Inc. 139
Penrod Drilling Company 206
Powell Valves 22
Radio Frequency Laboratories, Inc. 20
Reda Pump Company 169
Rockwood Sprinkler Company 173
Roots-Connersville Blower, A Division of Dresser Industries, Inc. 35
R-P&C Valve Division American Chain & Cable 68
Schlumberger Well Surveying Corp. 166, 167
Scott-Rice Company 172
Shell Oil Company 206
Smith Corporation, A. O. Tubular Products Division 14
Smith Oil Tool Co., H. C. 28, 29
Southern Mill & Mfg. Co. 152
Southwestern Plastic Pipe Co. 195
Spang & Co. 43
Standard Oil Company of Indiana 212
Stran-Steel Corporation 126
Thompson Tool Co. 69
Thornhill-Craver Co. 190
Tuboscope Company 26
Tulsa Crating Co. 8
United States National Bank 154
United States Steel Corporation—Oil Well Supply Division 202
Universal Atlas Cement Co. 6
Vogt Machine Co., Henry 182
Wall Colmonoy Corporation 42
Waukesha Sales & Service, Inc. 211
Weatherford Oil Tool Co. 70
Well Equipment Mfg. Corp. 93
Western Company 204
Wheland Company, The 52, 53
Wilkening Manufacturing Co. 60
Williams & Co., J. H. 51
Wilson Manufacturing Co., Inc. 205
Worthington Corporation 189
45, 156

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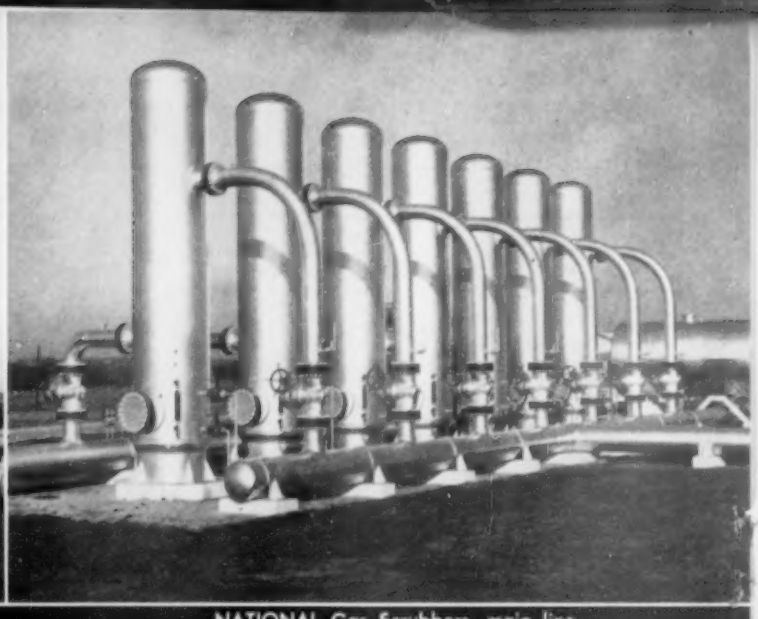

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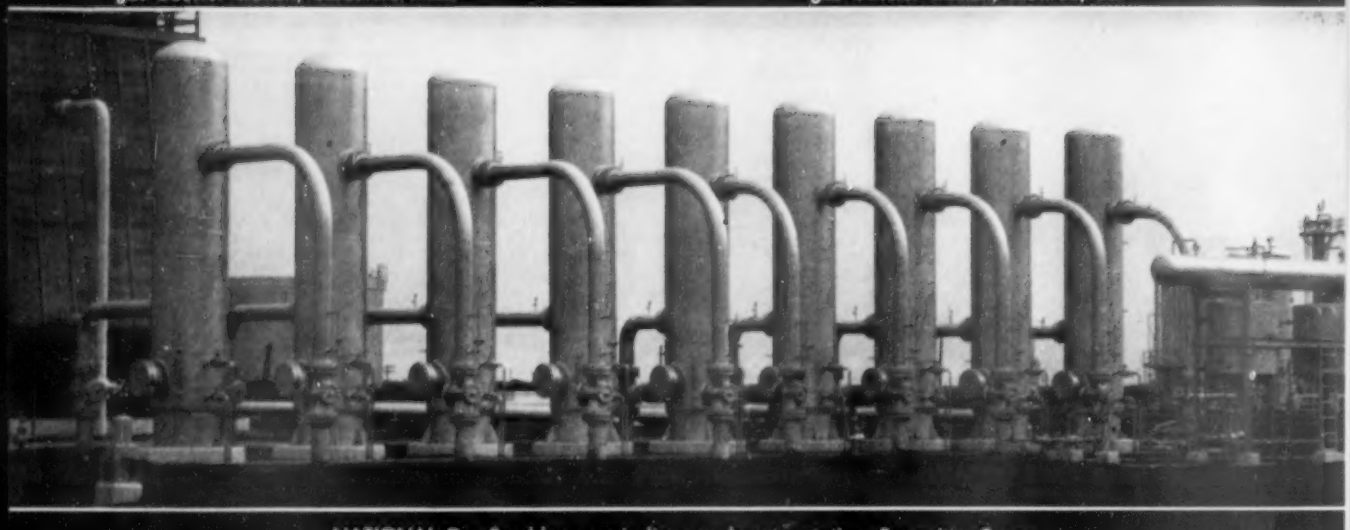

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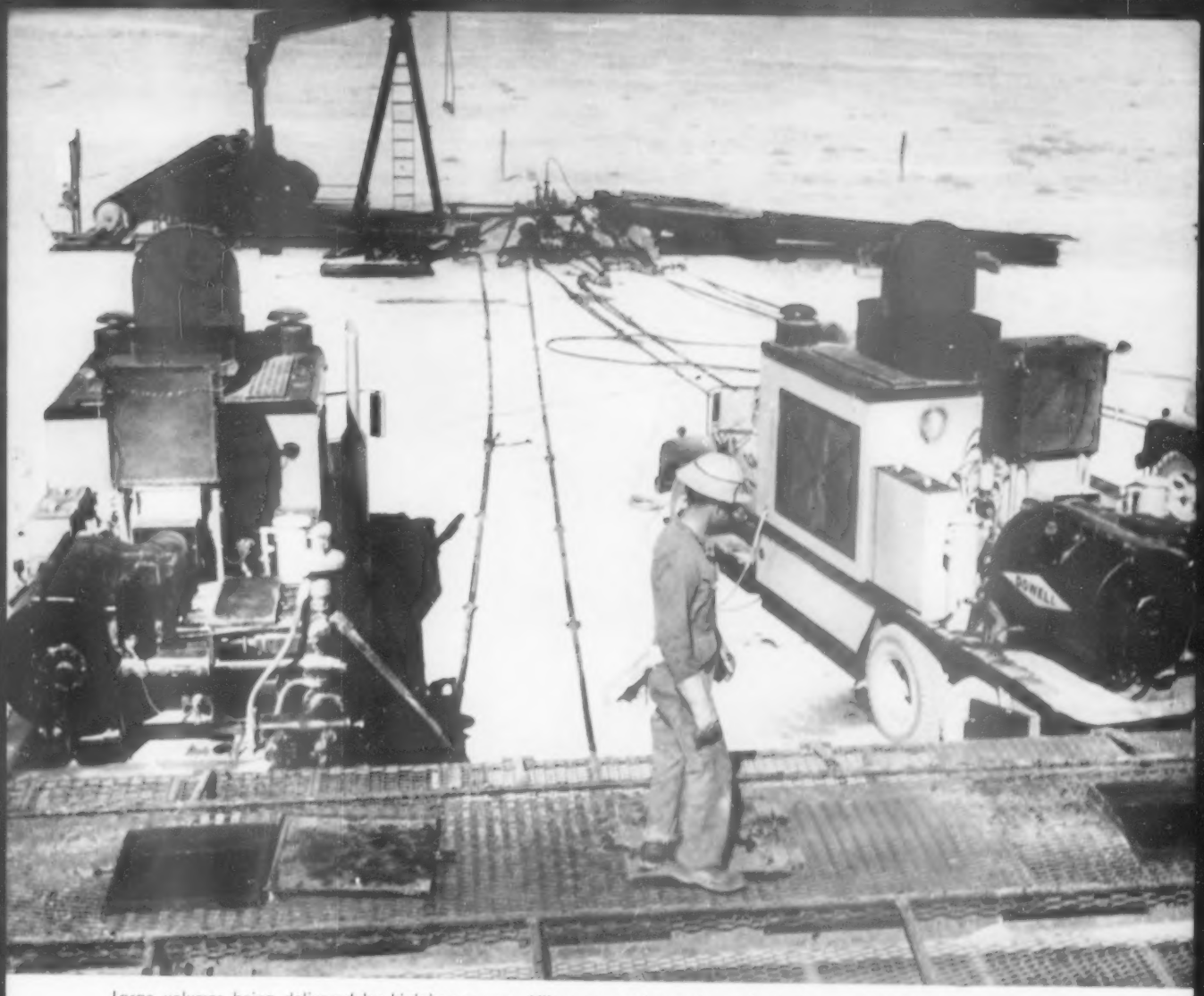

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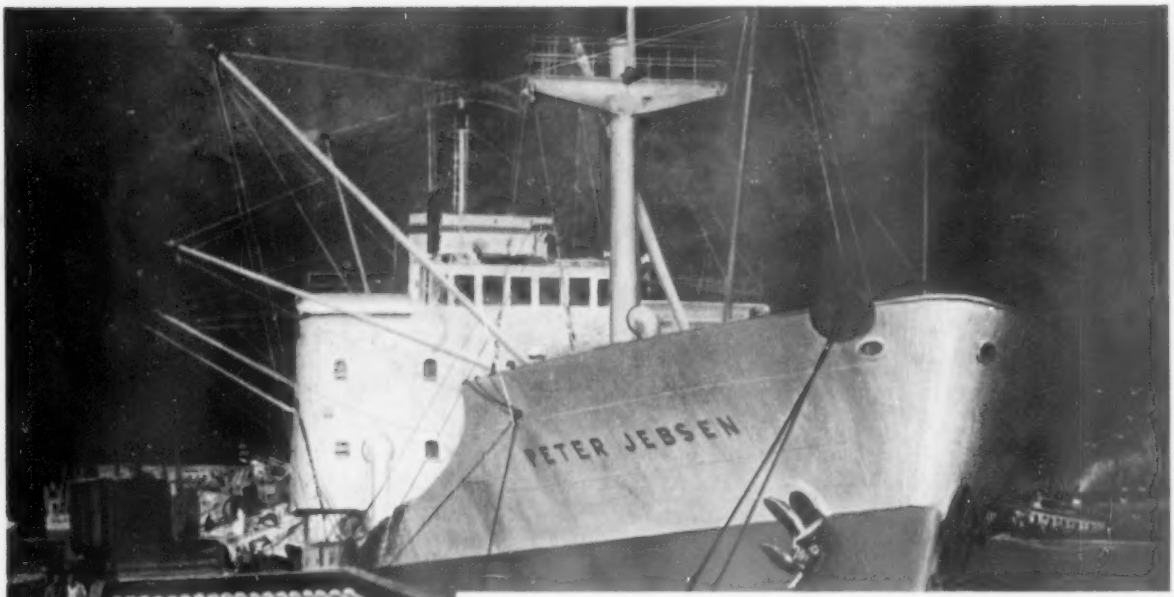

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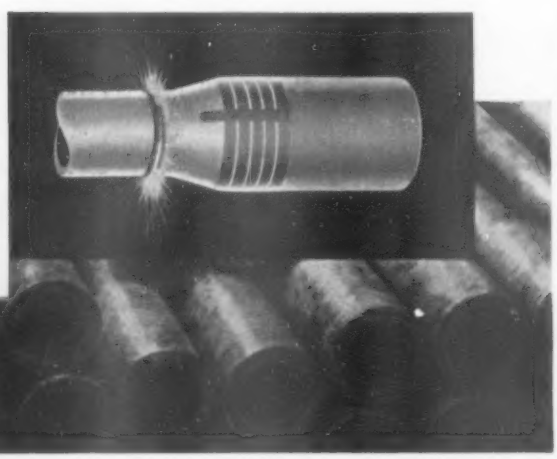
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